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Volume 8 Number 13 / July 8, 1970

TABLE OF CONTENTS

Subject Categories

Abstracts in the journal are grouped under the following categories:

page:

01 AERODYNAMICS
Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion. **2317**

02 AIRCRAFT
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **2320**

03 AUXILIARY SYSTEMS
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. **2322**

04 BIOSCIENCES
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. **2324**

05 BIOTECHNOLOGY
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences. **2329**

06 CHEMISTRY
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. **2332**

07 COMMUNICATIONS
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. **2345**

08 COMPUTERS
Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics. **2352**

09 ELECTRONIC EQUIPMENT
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation. 2357

10 ELECTRONICS
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories. 2360

11 FACILITIES, RESEARCH AND SUPPORT
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations. 2362

12 FLUID MECHANICS
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion. 2365

13 GEOPHYSICS
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences. 2371

14 INSTRUMENTATION AND PHOTOGRAPHY
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras. 2379

15 MACHINE ELEMENTS AND PROCESSES
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection. 2389

16 MASERS
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State. 2393

17 MATERIALS, METALLIC
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see : 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics. 2395

18 MATERIALS, NONMETALLIC
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics. 2403

19 MATHEMATICS
Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers. 2408

20 METEOROLOGY
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences. 2418

21 NAVIGATION
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications. 2424

22 NUCLEAR ENGINEERING
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems. 2426

23 PHYSICS, GENERAL
Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation. 2438

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation. 2440

25 PHYSICS, PLASMA
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems. 2455

26 PHYSICS, SOLID-STATE
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics. 2461

27 PROPELLANTS
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems. 2469

28 PROPULSION SYSTEMS
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants. 2470

29 SPACE RADIATION
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear. 2472

30 SPACE SCIENCES
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles. 2477

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics. 2482

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic. 2484

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants. 2490

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents. 2495

SUBJECT INDEX I-1

PERSONAL AUTHOR INDEX I-63

CORPORATE SOURCE INDEX I-93

CONTRACT NUMBER INDEX I-113

REPORT/ACCESSION NUMBER INDEX I-119

ACCESSION/REPORT NUMBER INDEX I-131

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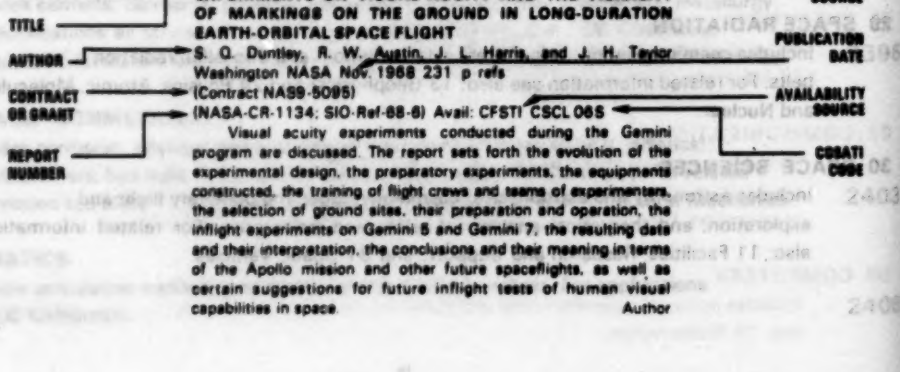
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AUTHOR
S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
PUBLICATION DATE
Washington NASA Nov. 1968 231 p refs
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REPORT NUMBER
(NASA-CR-1134; SIO-Ref-68-6) Avail: CFSTI CSCL 06S
COSATI CODE
Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space.
Author

VOLUME 8 NUMBER 13 / JULY 8, 1970

Scientific and Technical Aerospace Reports

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Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N70-26553*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Environmental Sciences Div.

REDUCTION OF THE VISCOUS SHOCK-LAYER EQUATIONS TO BOUNDARY-LAYER EQUATIONS

W. A. Schneider 1 May 1970 14 p refs

(Contract NAS7-100)

(NASA-CR-109649; JPL-TR-32-1459) Avail: CFSTI CSCL 20D

The shock layer at a blunt body in hypersonic flow is studied in the Reynolds number regime where strong (nonlinear) vorticity interaction occurs between the viscous and the inviscid parts of the shock layer. The differential equations of a thin shock layer are reduced to classical boundary-layer equations on the basis of the assumption that the pressure across the viscous part of the shock layer varies only slightly. The transformations of variables that accomplish this reduction are given for various coordinate systems. Author

N70-26569*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FLIGHT INVESTIGATION OF AIRFRAME INSTALLATION EFFECTS ON A VARIABLE FLAP EJECTOR NOZZLE OF AN UNDERWING ENGINE NACELLE AT MACH NUMBERS FROM 0.5 TO 1.3

Daniel C. Mikkelsen and Verlon L. Head Washington May 1970 51 p refs

(NASA-TM-X-2010; E-5467) Avail: CFSTI CSCL 20D

A modified F-106B aircraft with underwing engine nacelles was flight tested to investigate airframe installation effects on a variable flap ejector nozzle. Boattail drag coefficients, nacelle and wing pressures, and boundary-layer measurements were obtained for three 15 deg conical boattails with projected area equal to 54.8 percent of the nacelle area. Three boattail juncture radii of curvature were tested at nonreheat and at reheat power settings. The installed boattail pressure drag coefficients were lower than isolated nozzle values at subsonic speeds, and boattail transonic drag rise was delayed to Mach 0.97. Author

N70-26850# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PROBLEM OF WING FLUTTER NEAR A DEFLECTOR

V. N. Buyvol et al 2 Oct. 1969 16 p refs Transl. into ENGLISH from Gidroninamika Bolshikh Skorostei (USSR), no. 5, 1968 p 35–44

(AD-700593; FTD-HT-23-375-69) Avail: CFSTI CSCL 1/3

An approach to the problem of wing flutter near a deflector is presented. The analysis assumes the flow of an incompressible nonviscous fluid flow, and the method presented may be used if an inverse operator can be found for the equations of elastic equilibrium of the wing. The nonsteady motion of a thin wing of infinite span upon a solid surface is depicted. This given expression is the basic system that is solved, and it can be regarded as the flutter equations for a wing with two degrees of freedom. The flutter is studied as a class of harmonic vibrations, and the solution, which contains transcendental functions, can be worked out by successive approximations or by another suitable numerical method. The proposed solution is applied, in an example, to the planar problem of flutter in a nonsteady flow of an ideal fluid. Author (TAB)

N70-26933*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DRAG CHARACTERISTICS OF SEVERAL TOWED DECELERATOR MODELS AT MACH 3

Robert Miserentino and Herman L. Bohon Washington May 1970 33 p refs Film supplement number L-1075 to this report is available on loan from LRC, Langley Station, Va.

(NASA-TN-D-5750; L-6864) Avail: CFSTI CSCL 01A

The possibility of using toroid-membrane and wide-angle conical shapes as towed decelerators was investigated. Parameter variations were investigated which might render toroid-membrane models and wide angle-cone models stable without loss of the high drag coefficients obtainable with sting-mounted models. The varied parameters included location of center of gravity, location of the pivot between the towline and the model, and configuration modifications of the aft end as the addition of a corner radius and the addition of a skirt. The toroid membrane can be made into a stable towed decelerator with a suitable configuration modification of the aft end. Cones with apex angles greater than 90 deg did not have improved values of drag coefficient even when somewhat stabilized by varying the corner radius or skirt. Author

N70-26985*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PERFORMANCE AND DEPLOYMENT CHARACTERISTICS OF TWIN-KEEL PARAWING WITH VARIOUS AMOUNTS AND PERMEABILITIES OF POROUS MATERIAL IN OUTER LOBES

Harry L. Morgan, Jr. Washington May 1970 38 p refs

(NASA-TN-D-5793; L-6961) Avail: CFSTI CSCL 01A

Five models with nominal keel lengths of 6.25 feet (1.91 meters) were constructed and tested. The permeability of the porous materials used in the outer lobes was either 0, 32.0, or 96.0 cubic ft/min/square ft (0, 0.16, or 0.49 cubic m/sec/square m) at 1/2 inch (1.27 cm) of water, and the amount of porous material was either 0, 38.9, or 75 percent of the total area of the outer lobes. The test results indicate that the addition of the various amounts and permeabilities of porous materials has little effect on the deployment loads but causes a reduction in flight performance.

The increase in permeability causes a reduction in flight performance. The increase in permeability causes a reduction in the maximum obtainable lift-drag ratio from 2.90 to 2.13. The increase in the amounts and permeabilities of the porous materials had little effect on the canopy inflation time or on the maximum resultant-force coefficient during deployment. Author

N70-26993# Sandia Corp., Albuquerque, N.Mex. Experimental Aerodynamics Div.

AN EXPERIMENTAL INVESTIGATION OF THE FLOW FIELD AROUND AN INCLINED SHARP CONE IN HYPERSONIC FLOW

Oscar L. George, Jr. Sep. 1969 74 p refs

(SC-RR-69-577) Avail: CFSTI

An experimental investigation into the structure of the flow field surrounding a sharp 10 deg half-angle cone at angle of attack to a Mach number 7.3 flow was conducted. The investigation was conducted at two Reynolds number conditions to investigate Reynolds number dependence of the flow. A laminar boundary layer existed for both test conditions. Pitot pressure traverses of the entire shock layer were obtained, as were surface static pressure data for 8 deg and 12 deg angles of attack. Oil flow patterns were obtained in an angle of attack range of 8 deg to 16 deg. These data are presented in the form of graphs and photographs. An analysis of these data is performed which results in mappings of the flow field structures. Both attached and separated leeside flows are considered. An order-of-magnitude analysis of the leeside pressure data is used to infer the location of the vortical (entropy) singularity. Author

N70-27012# General Applied Science Labs., Inc., Westbury, N.Y.

THREE-DIMENSIONAL INVISCID FLOW ABOUT SUPERSONIC BLUNT CONES AT ANGLE OF ATTACK. PART 2: IMPROVED TIME-DEPENDENT TECHNIQUES FOR THE BLUNT BODY PROBLEM

G. Moretti Sep. 1968 31 p refs Sponsored by AEC Prepared for Sandia Labs.

(SC-CR-68-3728) Avail: CFSTI CSCL 20D

The accuracy and usefulness of the numerical solution of the shock layer of a blunt body at angle of attack is dependent on the coordinate system used. The polar coordinate system developed herein has several advantages over the cylindrical system. Two main advantages of the polar coordinate system are: (1) The geometry of the output line is more adaptable for starting data to an afterbody program and reduces the supersonic volume calculated by the nose region method; (2) The geometry of the body is not limited to positive slopes. The polar equations of motion for ideal gas are given. A transformation is applied to the volume of interest to map it into a right parallelepiped. The transformed equations are given and the procedure required to use the Lax-Wendroff type of numerical scheme to solve these equations is outlined. Mesh size, nose bluntness, and free stream Mach number effects on the accuracy of results are discussed. Author

N70-27024# Massachusetts Inst. of Tech., Cambridge.

VORTICITY AND THE AERODYNAMICS OF THE MODERN AIRPLANE

Erik Mollo-Christensen 18 Jun. 1969 39 p

(Contract AF 49(638)-1493)

(AD-701403; AFOSR-70-0320TR) Avail: CFSTI CSCL 1/1

Selected topics in aerodynamics and meteorology affecting aircraft flight and involving rotational flow are discussed. Author (TAB)

N70-27028*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INCREASING THE STABLE OPERATING RANGE OF A MACH 2.5 INLET

Bobby W. Sanders and Glenn A. Mitchell Jun. 1970 17 p refs Presented at the 6th Propulsion Joint Specialist Conf., San Diego, Calif., 15-19 Jun. 1970; sponsored by AIAA

(NASA-TM-X-52799) Avail: CFSTI CSCL 20D

The results of an experimental investigation to increase the stable operating range of a supersonic mixed-compression inlet are presented. Large stability margins were obtained with inlet throat bleed systems utilizing controlled bleed plenum pressure. These throat bypass systems removed airflow through either distributed normal holes, distributed educated slots, or a single forward-facing slot. Control of the bleed plenum pressure was provided by variable choked exits, vortex valves, or self-acting mechanical valves. Stability limits were determined for steady-state operation and transient internal airflow distrubances. Mechanical valve instability was encountered at some discrete inlet operating conditions. Author

N70-27067# General Applied Science Labs., Inc., Westbury, N.Y.

THREE-DIMENSIONAL INVISCID FLOW ABOUT SUPERSONIC BLUNT CONES AT ANGLE OF ATTACK. PART 1: NUMERICAL TECHNIQUE FOR THE THREE-DIMENSIONAL BLUNT-BODY PROBLEM

G. Moretti and G. Bleich Sep. 1968 83 p refs Sponsored by AEC. Prepared for Sandia Labs.

(SC-CR-68-3728) Avail: CFSTI

A technique for computing the ideal gas flow about a supersonic axisymmetric body at an angle of attack is developed. The system initially defined in a cylindrical coordinate system is transformed into a rectangular space for the time-dependent mathematical development. The rectangular space is bordered by the bow shock, the body, the bordering cylindrical surface and meridional planes. Calculations are begun by assuming a shock shape and calculating the flow across this shock layer by combined use of the Rankine Hugoniot jump equations and a four dimensional method of characteristics scheme. The flow within the boundaries of the rectangular region are calculated by a time-dependent explicit Lax-Wendroff type numerical scheme. The body surface properties are also calculated using a method of characteristics scheme. The developed technique has the capability of calculating the shock layer over a wide range of geometries and free stream conditions, including Mach numbers larger than two and angles of attack from zero degrees to 35 degrees. Author

N70-27175# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.

WING-EDGE PIVOT POINTS IN SUBSONIC LIFTING SURFACE ANALYSIS

Peter F. Jordan Nov. 1969 21 p refs

(Contract F44620-69-C-0098)

(AD-700822; RIAS-TR-69-17C; AFOSR-69-3037TR) Avail: CFSTI CSCL 1/3

An elementary and instructive method is described for deriving formulas for the spanwise singularities. Prior results are reviewed, and additional terms are given. Author (TAB)

N70-27228*# Pratt and Whitney Aircraft, East Hartford, Conn.

HIGH-LOADING LOW-SPEED FAN STUDY. PART 2: DATA AND PERFORMANCE UNSLOTTED BLADES AND VANES

K. G. Harley and E. A. Burdsall [1969] 139 p refs

(Contract NAS3-10483)

(NASA-CR-72667; PWA-3653) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. CSCL 20D

A single-stage fan with a tip speed of 1000 ft/sec(304.8 m/sec) and a hub-tip ratio of 0.392 was tested from 65 to 110 percent of design speed. The tests were conducted with uniform inlet flow and with the inlet flow distorted both radially and circumferentially. At design speed, maximum stage pressure ratio was 1.484 and maximum efficiency was 88.1 percent. Stator-hub-slit suction was used to improve stator performance. Noise measurements were made at the stage inlet and exit and show trends different from those of other fans. Author

N70-27323*# Scientific Translation Service, Santa Barbara, Calif.
REPRESENTATION OF A LIFTING LINE IN AN ARBITRARY MOTION BY A LINE OF ACCELERATION DOUBLETS [REPRESENTATION D'UNE LIGNE PORTANTE ANIMEE D'UN MOUVEMENT ARBITRAIRE, PAR UNE LIGNE DE DOUBLETS D'ACCELERATION]
Roland Dat Washington NASA May 1970 19 p refs Transl. into ENGLISH from Rech. Aerospatiale (French), no. 133, Nov. - Dec. 1969 p 45 - 51
(Contract NASw-2035)
(NASA-TT-F-12952) Avail: CFSTI CSCL 20D

The lifting line theory in an arbitrary motion is developed towards it application to the study of the unsteady aerodynamics of helicopter blades. This results in an integral equation giving the velocity field as a function of the lift distribution and of its history. Author

N70-27349*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATIC AERODYNAMIC CHARACTERISTICS, PRESSURE DISTRIBUTIONS, AND RAM-AIR INFLATION OF ATTACHED INFLATABLE DECELERATOR MODELS AT MACH 3.0
William D. Deveikis and James Wayne Sawyer Washington May 1970 60 p refs
(NASA-TN-D-5816; L-6337) Avail: CFSTI CSCL 01C

Axial force, normal force, pitching moment, and ram and static pressure distributions were obtained on solid configurations representative of a supersonic decelerator concept. This concept utilizes an inflatable axisymmetric afterbody attached to the base of a 120 deg cone for drag augmentation and a burble fence located near the maximum diameter of the afterbody for subsonic stability. Two afterbody shapes were tested with burble fences that protruded above the surface as much as 20 percent of the afterbody maximum radius. Tests were also conducted to determine the feasibility of deploying an attached inflatable afterbody at supersonic speed. Aerodynamic forces were obtained at angles of attack up to 12 deg and at freestream Reynolds number of 1.1 million and 3.0 million. Ram and static pressures were obtained at zero angle of attack and at a free stream Reynolds number of 9.8 million. Inflatable models were tested at zero angle of attack and at free stream Reynolds numbers between 13.9 million and 18.5 million for ratios of afterbody volume to ram inlet area between 355 and 1167 inches. Reynolds numbers are based on maximum diameter of the afterbody. Author

N70-27365# National Physical Lab., Teddington (England). Aerodynamics Div.
EXPERIMENTS WITH BICONVEX AND DOUBLE-WEDGE AEROFOILS IN LOW-DENSITY, SUPERSONIC FLOW
E. W. E. Rogers and C. J. Berry 13 Nov. 1968 69 p refs
(NPL-AERO-1282; ARC-30678) Copyright. Avail: CFSTI

Surface pressures over a wide range of incidence, for stream Mach numbers between 1.79 and 4.19 and Reynolds numbers between 93 and 1920, have been correlated by means of modified viscous-interaction parameters, based on equivalent free-stream conditions for the local flow. Behind the wedge shoulder and over the biconvex surface the full surface expansions are not achieved, due to the thick laminar boundary layer. The section lifts and pressure drags have been determined and show the strong influence of the viscous-induced pressure increment. Author (ESRO)

N70-27419*# National Aeronautics and Space Administration, Washington, D.C.
DESCRIPTION AND EFFECT OF UNSTEADY GUST DERIVATIVES OF THE LONGITUDINAL MOTION OF AN AIRCRAFT [BESCHREIBUNG UND AUSWIRKUNG INSTATIONAERER BOEENDERIVATIVA DER FLUGZEUGLAENGSBEWEGUNG]
G. Schanzer May 1970 39 p refs Transl. into ENGLISH from Proceedings of the Meeting of the Duet. Ges. fuer Luft- und Raumfahrt (Bremen), 22-24 Sep. 1969 42 p
(NASA-TT-F-12753) Avail: CFSTI CSCL 01A

Unsteady flows caused by rough air and their effect on the longitudinal motion of an aircraft and on flight stability and control are analyzed. It is shown that a quasi-steady-state method of investigation is sufficient for the relatively slow motion of the aircraft in the direction of its flight. Quasi-steady-state parameters are derived for horizontal and vertical effects of rough air. The effect of vertical and horizontal perturbations is discussed for aircraft types similar to the Boeing 707 and to the Concorde. Author

N70-27452# United Aircraft Corp., East Hartford, Conn. Research Labs.
VORTEX GENERATORS Summary Report
H. D. Taylor 7 Mar. 1950 18 p refs Publicly released by UAC in 1970
(R-05280-9) Avail: CFSTI

This report contains a summary of the results of the many successful applications utilizing vortex generators, which were developed as a fluid mixing device. Also, the purpose and a description of the vortex generators together with design criteria for a typical diffuser application are presented. References are made to reports covering in greater detail the results of the several applications. Author

N70-27457# National Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
PRESSURE MEASUREMENTS ON AN AEROFOIL DESIGNED FOR A 'ROOFTOP' TYPE OF PRESSURE DISTRIBUTION AT A CRITICAL MACH NUMBER OF 0.688
J. W. Slooff 11 Nov. 1968 73 p refs Sponsored by Min. of Defense, Neth.
(NLR-TN-T-157) Avail: CFSTI CSCL 20D

Pressure distributions were measured on a 10.5 percent thick, two-dimensional aerofoil designed to have an upper surface pressure distribution of the 'rooftop' type at a critical Mach number of 0.688. It was found that at near-design conditions the maximum suction on the aerofoil overshoots the predicted value significantly. As a result, the critical Mach number was 0.67 instead of 0.688 at the design lift coefficient of 0.414. Author (ESRO)

N70-27474*# National Aeronautics and Space Administration, Washington, D.C.
HYPERSONIC FLOW PAST BLUNT CONES WITH CONSIDERATION OF THE EQUILIBRIUM PHYSICOCHEMICAL TRANSFORMATIONS
V. V. Lunev et al May 1970 202 p refs Transl. into ENGLISH of the book 'Giperzvukovoye Obtekaniye Prituplennykh Konusov s Uchetom Ravnovesnykh Fiziko-Khimicheskikh Prevrashcheniy' Moscow, Computer Center of the Acad. of Sci., 1968 p 5 - 22
(NASA-TT-F-543) Avail: CFSTI CSCL 20D

The results of calculating the flow of air past blunt cones at angles of attack of 0, 5, and 10 deg with consideration of equilibrium physicochemical transformations occurring in it during flight at hypersonic velocities, and by an ideal gas with the adiabatic index of 1.4, are presented in tabular form. The tables encompass a range of flight velocities of 3000 to 10,000 m/sec in the earth's atmosphere, and a range of Mach numbers of 4 to infinity for an ideal gas, with a range of half-cone angles of the cone from 0 to 20 deg, and they contain the distribution of parameters along the surface of the body, shock wave, and, in individual cross-sections, between the body and the shock wave. The volume of tabular data presented with consideration of the possibilities of the hypersonic theory of similarity, the basic results of which are outlined briefly is adequate for determining the characteristics of flow past cones with noses of arbitrary shape within the specified range of change of the parameters. Author

N70-27489# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
INVESTIGATION OF THE INFLUENCE OF A FIXED SPOILER ON THE AERODYNAMIC COEFFICIENTS OF CYLINDRICAL BODIES IN HYPERSONIC FLOW [UNTERSUCHUNGEN UEBER DEN EINFLUSS EINES FESTEN SPOILERS AUF DIE AERODYNAMISCHEN BEIWERTE ROTATIONSSYMETRISCHER KOERPER IM HYPERSCHALL]
Wolfgang Wyborny and Hans-Peter Kabelitz Dec. 1969 54 p refs In GERMAN; ENGLISH summary Sponsored by Deut. Forsch. Gemeinschaft
(DLR-MITT-69-24) Avail: CFSTI

Three-component measurements were carried out on cylindrical bodies with different noses and fixed spoilers in the DFVLR gun tunnel. It was concluded that an important effect for the normal forces, relating to higher drag, can only be detected if the spoiler is placed near the body-nose. It was not possible to calculate these forces because of the unsteady behavior of the flow around the spoiler. Author (ESRO)

N70-27515*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL INVESTIGATION OF A LARGE SCALE, TWO-DIMENSIONAL, MIXED-COMPRESSION INLET SYSTEM: PERFORMANCE AT DESIGN CONDITIONS M-3.0
Warren E. Anderson and Norman D. Wong Washington May 1970 56 p refs
(NASA-TM-X-2016; A-3507) Avail: CFSTI CSCL 20D

Data are presented for a large-scale variable-geometry inlet system operating at the design Mach number of 3.0. Variable features for off-design operation are an adjustable height ramp system and a translating cowl. Total-pressure recovery performance was high, with the maximum being 0.90 for a boundary-layer-bleed mass-flow ratio of 0.146 at alpha and beta equal to 0 deg. The effects of boundary-layer bleed, subsonic diffuser shape, throat-mounted vortex generators, and other geometric variables were evaluated experimentally. Author

N70-27576*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EXPLORATORY WIND-TUNNEL INVESTIGATION OF THE WAKE EFFECT OF A PANEL TIP-MOUNTED FAN-JET ENGINE ON THE LIFT-INDUCED VORTEX
James C. Patterson, Jr. and Stuart G. Flechner Washington May 1970 41 p refs
(NASA-TN-D-5729; L-6898) Avail: CFSTI CSCL 20D

An investigation was conducted in a transonic pressure tunnel to determine the effectiveness of a tip-mounted powered-model high-bypass fan-jet engine in reducing the tip vorticity of an unswept symmetrical panel. The effects of end plates, a body of revolution, and flow-through nacelle on panel-tip vorticity were also determined for comparison. All tests were conducted at a Mach number of 0.70, at angles of attack from approximately 0 deg to 4 deg, and at a Reynolds number of 3,820,000 based on the mean geometric chord of 33.17 centimeters. Author

N70-27724# Sandia Corp., Albuquerque, N.Mex.
YAW OF REPOSE ON SPINNING SHELLS
Harold R. Vaughn and Gerald G. Wilson Jan. 1970 26 p refs Sponsored by AEC
(SC-RR-70-155) Avail: CFSTI

A detailed theoretical development of the yaw of repose angle, which develops on spin stabilized shells, is presented, and its importance in ballistic matching problems is shown. Author

N70-27726# IIT Research Inst., Chicago, Ill. Dept. of Mechanical and Aerospace Engineering.
ON THE MANY FACES OF TRANSITION
Mark V. Morkovin 16 Jan. 1970 34 p refs
(Contract F44620-69-C-0022)
(AD-701271; AFOSR-70-0293TR) Avail: CFSTI CSCL 20/4

Conceptual lessons are drawn from a recently completed critical survey of the literature on transition to turbulence, and a number of unifying conjectures are advanced for subsonic speeds. In particular, the roles of linear amplification, nonlinear limiting, and secondary instability inducted by unsteady nonlinear effects are discussed. These mechanisms are illustrated for a number of transitional flows, including those in presence of roughness and streamwise vorticity. A clarification is advanced for the question of fast versus slow transition. Finally, an overall model of the linear and nonlinear processes leading to transition is proposed. Author (TAB)

N70-27791 National Lending Library for Science and Technology, Boston Spa (England).
AERODYNAMICS OF A TWISTED FLOW IN AN ANNULAR PASSAGE [AERODINEMIKA ZAKRUCHENNOGO POTOKA V KOL'TSEVEN KANALE]
A. V. Sudarev 5 Aug. 1969 8 p refs Transl. into ENGLISH from Energomashinostroenie (Moscow), v. 15, no. 1, 1969 p 45–46
(NLL-Trans-4361-(9022.310)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The aerodynamics of a twisted flow in an annular passage was studied to investigate the intensification of convective heat exchange using different types of turbulence agents. By examining the velocity distribution, a mechanism of convective heat exchange is proposed. Comparative measurement data on the axial and tangential velocity components of air flow are given. S.S.

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N70-26572# Lockheed-Georgia Co., Marietta.
BIBLIOGRAPHY OF CONVENTIONAL LARGE TRANSPORT AIRCRAFT HANDLING QUALITIES AT SUBSONIC SPEEDS
A. J. Kuchinka 1 Jan. 1969 59 p refs
(ER-10045) Avail: CFSTI

The bibliography presented is basically restricted to conventional subsonic large transport aircraft but also contains a few reports on STOL and supersonic models. The material covered is divided into eight categories and includes: (1) bibliographies; (2) conference proceedings; (3) general interest reports; (4) lateral-directional pilot opinions; (5) longitudinal pilot opinions; (6) longitudinal and lateral-directional pilot opinions; (7) specifications; and (8) unreviewed reports. D.L.G.

N70-26890# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
A NON-GAUSSIAN TURBULENCE SIMULATION Final Report, Oct. 1967 – May 1969
Paul M. Reeves Nov. 1969 77 p refs
(Contract F33615-67-C-1851)
(AD-701735; AFFDL-TR-69-67) Avail: CFSTI CSCL 1/3

A comparison of the statistical properties of low altitude atmospheric turbulence and the characteristics of presently used simulation techniques shows that these techniques do not satisfactorily account for the non-Gaussian nature of turbulence. A non-Gaussian turbulence simulation, intended to be used in conjunction with piloted flight simulators, is developed. The simulation

produces three simultaneous random processes which represent the three orthogonal gust components. The probability distribution of each component is characterized by a modified Bessel function. The rms intensity and scale length of each component are independent parameters. A general method of introducing cross spectra between components is demonstrated. The multiplication of independent random processes is used to generate each of the gust components. Gaussian white noise generators, analog multipliers, and linear filters are used throughout the simulation. A complete analog circuit diagram is presented. Author (TAB)

N70-26948# Systems Technology, Inc., Hawthorne, Calif.
A SYSTEMS ANALYSIS OF MANUAL CONTROL TECHNIQUES AND DISPLAY ARRANGEMENTS FOR INSTRUMENT LANDING APPROACHES IN HELICOPTERS. VOLUME 1: SPEED AND HEIGHT REGULATION Final Report
Warren F. Clement and Lee Gregor Hofmann Jul. 1969 232 p refs Sponsored in part by the Army Electron. Command
(Contract N00014-68-C-0443)
(AD-700946; STI-TR-183-1; JANAIR-690718) Avail: CFSTI CSCL 1/3

A comprehensive theory for displays used in manual control systems is applied to the instrument-landing approach problem for helicopters. A single-articulated-rotor transport and a compound rigid-rotor attack helicopter serve as examples. A comparative analysis of manual control techniques for speed and height regulation in the approach is given. Suitable display arrangements and task performance are predicted for the better control techniques. The applications of the theory incorporate recent revisions for predicting eye scanning patterns, workload measures and preferred arrangements for combined displays as well as separated instruments. Results show how display combinations which enhance the usefulness of parafoveal perception can reduce scanning workload. Other immediate applications of the theory and areas for future research are suggested. Author (TAB)

N70-27004# Naval Postgraduate School, Monterey, Calif.
INTERFACE OF MATERIALS AND STRUCTURES ON AIRFRAMES. PART 1: BASIC DESIGN CONSIDERATIONS
Ulrich Haupt Nov. 1969 64 p refs
(AD-700712; NPS-57HP9111A-Pt-1) Avail: CFSTI CSCL 1/3

The interface of materials and structures is of particular importance during the early design phases of an aircraft when decisions regarding the choice of material and corresponding structural configuration have to be made. This part of the design process is considered from the viewpoints of materials, structures, and design engineers. While well-defined problems in each of these fields are in the hands of competent specialists, it is shown that major problems also exist in the ill-defined regions between these specialties and have beckoned vainly for any systematic approach toward their solution. These problems are identified and steps toward their solution are recommended in some detail. Author (TAB)

N70-27178*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL INVESTIGATION OF A VTOL JET-TRANSPORT MODEL WITH POWERED LIFT ENGINES IN PODS AT WING MIDSPAN OR INBOARD
Raymond D. Vogler Washington Apr. 1970 152 p refs
(NASA-TN-D-5770; L-6962) Avail: CFSTI CSCL 01C

Four ejectors mounted in each pod under each wing and powered with compressed air were used to simulate vertical-lift, fan-type jet engines. Data were obtained through an angle of attack range to show the effects of engine-pod location, ground-plane movement, flaps, tail size and location, and 10 deg of sideslip on the aerodynamic characteristics of the model, and the effects of configuration changes on the jet and free-stream interference increments. Author

N70-27248*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SUBSTANTIATION DATA FOR HYPERSONIC CRUISE VEHICLE WING STRUCTURE EVALUATION. VOLUME 1, SECTIONS 1-10
P. P. Plank, I. F. Sakata, G. W. Davis, and C. C. Richie 15 Feb. 1970 438 p refs
(Contract NAS1-7573)
(NASA-CR-66897-1) Avail: CFSTI CSCL 01C

An analytical and experimental evaluation was performed for several promising structural concepts to provide the basis of minimum total-system-cost for selection of the best concepts for the design of a hypersonic vehicle wing. Detailed substantiation data are given. Vehicle loads and temperatures are given with each structural analysis that influences weight. In addition to the weight analysis, fabrication cost, performance penalites (surface roughness drag), reliability, and total-system-cost analyses are presented. Author

N70-27249*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
HYPERSONIC CRUISE VEHICLE WING STRUCTURE EVALUATION. VOLUME 2, SECTIONS 11-22
P. P. Plank, I. F. Sakata, G. W. Davis, and C. C. Richie 15 Feb. 1970 557 p refs
(Contract NAS1-7573)
(NASA-CR-66897) Avail: CFSTI CSCL 01C
For abstract see N70-27248.

N70-27250*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
HYPERSONIC CRUISE VEHICLE WING STRUCTURE EVALUATION. VOLUME 3, SECTIONS 23-27
P. P. Plank, I. F. Sakata, G. W. Davis, and C. C. Richie 15 Feb. 1970 468 p refs
(Contract NAS1-7573)
(NASA-CR-66897) Avail: CFSTI CSCL 01C
For abstract see N70-27248.

N70-27273*# Translation Consultants, Ltd., Arlington, Va.
CALCULATION OF PARACHUTE OPENING SHOCK [DIE BERECHNUNG DER FUELLUNGSSTOSSKRAFT VON FALLSCHIRMEN]
K. H. Fu Washington NASA May 1970 24 p refs Transl. into ENGLISH from the publ. "Parachute Eng. and Recovery Systems" Brunswick, DFVLR, Inst. fuer Flugmech., Sep. 1969 p 118 140
(Contract NASw-2038)
(NASA-TT-F-12908) Avail: CFSTI CSCL 01C

The effect of the parameters (mass, air density and velocity) on the openeing shock factor for the circular flat parachute is investigated. The opening forces are calculated not only according to the method given in the Parachute Handbook of the U.S. Air Force but also by using the opening relations given by R. Berndt. Author

N70-27378*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTICAL STUDY OF EFFECTS OF AUTOPILOT OPERATION ON MOTIONS OF A SUBSONIC JET-TRANSPORT AIRPLANE IN SEVERE TURBULENCE
William P. Gilbert Washington May 1970 35 p refs
(NASA-TN-D-5818; L-7029) Avail: CFSTI CSCL 01C

An analytical study was conducted to determine the capability of a conventional autopilot system to control a subsonic jet transport airplane in severe turbulence. Various configurations of a simplified three axis attitude-hold autopilot were evaluated to determine an optimum configuration for prevention of lateral upsets caused by reversal of dihedral effect. Author

N70-27602# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
AERIAL ARMORED FUSELAGE ENGINEERING AND

MANUFACTURING REPORT, PART 1 Final Technical Report, 1 Jul. 1969–15 Feb. 1970
Carleton W. Burr, William G. Degnan, Arthur W. Grumm, and Colin O. McCaul Feb. 1970 84 p
(Contract DAAG46-69-C-0159)
(AD-701925; AMMRC-CR-70-2/1) Avail: CFSTI CSCL 1/3

Manufacturing methods and techniques were evaluated for the use of advanced armor as the basic structural material of a helicopter fuselage. A standard threat was established based on the environment and experience of the helicopter in Viet Nam. Four armor materials were studied and dual hardness steel armor proved to be more cost effective than other materials. A prismatic fuselage shape was found to be optimal. Ballistic test panels of joined armor were fabricated. A full scale mock-up of an Aerial Armored Personnel Carrier using dual hardness steel armor as the structural material for the fuselage was fabricated to further explore the manufacturing methods and techniques developed. Potential problem areas were identified and recommendations provided. Manufacturing methods of cutting, joining and finishing were studied. The best cutting methods employed were flame cutting and abrasive cutoff, although plasma cutting warrants further consideration. The best joining method employed was gas tungsten arc welding although automatic plasma arc welding would be considered for production. The best finishing method for the size and shape of a helicopter fuselage was a sprayed epoxy resin system on a zincilate base. A preliminary conceptual helicopter design study resulted in an armor-hulled aircraft with a gross weight of 14,279 pounds, a dash speed of 125 knots, and a cruise speed of 80 knots carrying 12 troops and pilot for three hours endurance. The power plant included 2 advanced technology engines providing 3000 horsepower total. Hover performance is based on Army hot day criteria. Author (TAB)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N70-26817*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CAPACITOR POWER PAK Patent Application
Joseph R. Goudy, Clyde J. May, and James C. Ward, Jr., inventors (to NASA) Filed 8 Oct. 1969 7 p
(NASA-Case-LAR-10367-1; US-Patent-Appl-SN-864710) Avail: CFSTI CSCL 10B

An energy source for initiating pyrotechnic devices on vehicles and spacecraft is described. A bank of parallel connected tantalum capacitors are connected in a circuit with a bank of miniature silver oxide button cells such that the capacitors can be charged by the button cells. The charge on the capacitors is used to fire pyrotechnic devices. This miniaturization results in a weight and volume savings in excess of 70% over previous means. NASA

N70-26885# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN ADJUSTING DOUBLE-RIM STAGE WITH THE SECOND RIM BYPASSED AT HIGH LOADS
I. I. Kirillov et al 6 Nov. 1969 13 p refs Transl. into ENGLISH from Energomashinostroenie (Moscow), v. 11, no. 9, 1965 p 7–9
(AD-700866; FTD-HT-23-295-68) Avail: CFSTI CSCL 10/1

In turbines operating at a variable rotational speed large variations in operating conditions are connected with large losses in energy. The losses in ordinary adjusting stages substantially affect the overall efficiency of the turbine irrespective of the partial recovery of heat in the subsequent stages. The present article describes the results of the theoretical and experimental investigation of double-rim control stages with the second rim by-passed at higher loads. The material refers to turbines in which the characteristic number of the adjusting stage varies within a wide range depending on the operating conditions. Graphs cover the internal efficiencies, relative heat drop across the by-pass, the relative magnitudes of the kinetic energy, and the peripheral efficiency. TAB

N70-26947# North American Rockwell Corp., Canoga Park, Calif. Atomics International Div.
BASIC RESEARCH IN THERMIONIC ENERGY CONVERSION Technical Summary Report, 1 Aug. 1968–30 Nov. 1969
Charles Warner and Lorin K. Hansen Dec. 1969 102 p refs
(Contract Nonr-3192(00))
(AD-700945; AI-69-112) Avail: CFSTI CSCL 10/2

The program was directed toward an understanding of the fundamental processes occurring in thermionic energy converters and the effects of these processes on overall converter performance. A theoretical approach was studied for solving the equations which describe the wide spaced diode. In the past these equations have not been solvable with available techniques. With some reservations the new computer results agree with available experimental data. Secondly, the trapping of ions in potential wells was studied and a new criterion has been developed which relates parameters associated with double sheath emission barriers. This criterion will be useful in deciding the essential physics of converters operating below the knee of the I-V curve. Author (TAB)

N70-27132*# Gulton Industries, Inc., Hawthorne, Calif. Engineered Magnetics Div.
DESIGN AND MANUFACTURE OF STATIC INVERTER FOR BRAYTON POWER CONVERSION SYSTEM Final Report
G. Lachenmeier 3 Dec. 1969 146 p Prepared for Pesco Products, Div. of Borg-Warner Corp., Bedford, Ohio
(Contract NAS3-10935)
(NASA-CR-72671; Rept-2403) Avail: CFSTI CSCL 10A

The static inverter converts and conditions available dc power to 400 Hz quasi-square wave power to drive the pump motor assembly in the coolant loop of the brayton power conversion system. The static inverter has a tested efficiency of 94% and a calculated mean time between failure of 88511 hours. The theory of operation, electrical and mechanical design drawings, reliability calculations, parts selection, stress analysis, thermal calculations, and typical test results are given. Author

N70-27139*# Radio Corp. of America, New York.
NIMBUS-D SPARE STORAGE MODULE – TESTS AND ANALYSIS Summary Report, 15 Oct. 1969–13 Jan. 1970
13 Jan. 1970 30 p
(Contract NAS5-10470)
(NASA-CR-109726) Avail: CFSTI CSCL 10C

During the acceptance testing of spare storage modules 028, 031, and 032, several anomalies occurred which caused a special investigation to be undertaken to determine if the cells were overstressed sufficiently to make them unsuitable for flight use. An analysis indicated the overstresses were not sufficient to cause permanent damage. A special test program was formulated to prove the integrity of the modules. Modules 028 and 032 completed the series of special tests and exhibited normal characteristics throughout. SN 031 suffered what was considered permanent damage during a conditoning cycle and testing was discontinued on this module. For the sake of brevity only the tests during which an anomaly occurred and the special tests are shown. A description of the tests and the results are given. In addition to the special tests, the modules were subjected to the normal series of electrical confidence tests. During the special test program no unusual trends

were detected and the results were normal in every respect. Based on the analysis and the results of the special test program it is concluded spare modules 028 and 032 have not been degraded and are suitable for normal flight use. Author

N70-27161*# Fairchild Hiller Corp., Germantown, Md. Space and Electronics Systems Div.
FABRICATION FEASIBILITY STUDY OF A 30 WATT/POUND ROLL-UP SOLAR ARRAY Quarterly Report, 27 Jun.–30 Sep. 1967
W. G. King 15 Oct. 1967 83 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951989)
(NASA-CR-109850) Avail: CFSTI CSCL 10B

The study includes the parametric investigation of factors effecting the power/weight ratio and concentrates attention on the deployment/retraction mechanisms and supporting structures rather than on the electrical aspects of the design. Preliminary parametric study results are presented as are also conceptual designs of components for two array supporting structure configurations. Author

N70-27167*# Brown Univ., Providence, R.I. Div. of Engineering.
INVESTIGATION OF THE EFFECTS OF SUB-THRESHOLD HIGH ENERGY ELECTRONS ON THE PROPERTIES OF SILICON PHOTOVOLTAIC CELLS Final Report, 3 Feb.–3 Nov. 1969
J. J. Loferski and E. E. Crisman Feb. 1970 13 p Prepared for JPL
(Contracts NAS7-100; JPL-952386)
(NASA-CR-109851) Avail: CFSTI CSCL 10B

Measurements of the photovoltaic characteristics of p-n lithium-doped cells; p-n conventional cells and n-p cells are described. An experimental comparison of damage rates in a lithium doped p-n cell with a conventional p-n cell at approximately 90 K has shown that no effects associated with displacement of lithium ions by electrons whose energy is too low to displace Si atoms has been detected. A difference in damage rates at 200 keV was observed with the lithium doped cell exhibiting very little damage even though Li ions are not mobile at approximately 90 K. A deflection circuit to produce a scanned electron beam pattern is described. Author

N70-27179*# Boeing Co., Seattle, Wash. Aerospace Group
HIGH VOLTAGE SOLAR ARRAY STUDY Final Report
W. F. Springgate and Henry Oman [1969] 150 p refs
(Contract NAS3-11534)
(NASA-CR-72674; D2-121734-1) Avail: CFSTI CSCL 10B

The problems in operating a 15 kW, 2 to 16 kV solar array in Earth orbit are analyzed. The array would first power ion thrustors on a spacecraft climbing from 185 km to synchronous altitude, and then power transmitting tubes for 5 years. Such an array is feasible. Solar-cell interconnectors and other conducting surfaces would probably be insulated to prevent power loss through plasma. Several insulated-array designs appear practical. High-voltage insulations must be tested in the laboratory for performance in the ionospheric plasma, followed by 5 years in sychronous orbit. The leakage current from exposed conductors and through pinholes needs to be calculated for all plasma conditions, and confirmed experimentally. Author

N70-27229*# General Electric Co., Erie, Pa.
ALTERNATOR AND VOLTAGE REGULATOR-EXCITER FOR A BRAYTON CYCLE SPACE POWER SYSTEM. VOLUME 1: DESIGN AND DEVELOPMENT
A. M. Dryer, F. M. Kirkpatrick, E. F. Russell, J. M. Wimsatt, and L. J. Yeager Washington NASA May 1970 267 p refs Prepared for Pratt and Whitney, East Hartford, Conn.
(Contract NAS3-6013)
(NASA-CR-1451; A-69-003-Vol-1) Avail: CFSTI CSCL 10A

A homopolar inductor alternator and voltage regulator-exciter delivering 15 KVA, 0.8 power factor 120/208 volts, and 400 hertz power for a Brayton Cycle space power system has been developed and tested. Design objectives included high reliability, 90 percent efficiency, and aircraft alternator power quality. Manufacturing objectives included two stators, three rotors, and two Flyable voltage regulator-exciters for use in gas bearing turboalternators. Two Alternator Research Packages were also manufactured for separate component testing. Design philosophy and test results are presented. A Load Bank was also designed and built for use in a gas bearing test rig. Author

N70-27282*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STEADY-STATE CHARACTERISTICS OF A 1200-HERTZ ALTERNATOR AND ELECTRICAL CONTROLS OPERATING IN A SINGLE-SHAFT BRAYTON-CYCLE POWER SYSTEM USING KRYPTON GAS
Richard A. Edkin, Dennis A. Perz, Ernest A. Koutnik, and Milton J. Le Roy, Jr. Washington May 1970 14 p refs
(NASA-TM-X-2017; E-5586) Avail: CFSTI CSCL 10A

Steady-state performance of a 1200 Hz alternator, a voltage regulator, a series field controller, and a parasitic speed control is presented for an operating range of 1 to 10 kW. Test results show that the parasitic-load power factor (lagging) varied from 0.50 to 0.95. High neutral currents were measured with a maximum current of 21 A to 2.4 kW. Maximum voltage deviation from rated 120 V was 3.3 percent. Measured peak alternator hot-spot temperature was 495 F (257 C) at the rotor heat shield for an output of 10.1 kVA. Author

N70-27311*# Thermo Electron Corp., Waltham, Mass.
PERFORMANCE STABILITY OF PREFERRED-ORIENTED VAPOR-DEPOSITED TUNGSTEN EMITTERS FOR THERMIONIC CONVERTERS Final Report
C. C. Wang, F. Rufeh, D. Lieb, and T. O. P. Speidel 25 Apr. 1969 129 p refs
(Contract NAS3-9424)
(NASA-CR-72650; TE-4068-168-69) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 10A

The performance of tungsten, deposited from its halides by hydrogen reduction of hexafluoride (fluoride tungsten) and hexachloride (chloride tungsten), as emitters of thermionic converters was studied in seven planar geometry converters with niobium collectors and interelectrode spacings of 8 + or - 1/2 mils. The parametric data are presented in the form of variable cesium temperature families and cover an emitter temperature range of 1600 to 2000 K. The results show that the maximum power achieved with chloride tungsten emitters at a given emitter temperature is higher than that achieved with fluoride tungsten emitters throughout the temperature range studied. For example, at an emitter temperature of 2000 K, the maximum power achieved with chloride tungsten emitters is about twice that achieved with fluoride tungsten emitters. The performance of fluoride tungsten emitters was considerably improved by chemical etching and by the additional deposition of a thin layer of chloride tungsten on the surface of the fluoride tungsten (duplex tungsten). Performance stability was examined by life testing, which indicated that performance is stable with respect to time for test periods up to 4000 hours at emitter temperatures up to 2030K. Author

N70-27490# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
DEVELOPMENT OF A MECHANICAL ANTENNA DESPIN SYSTEM. PART 3: FURTHER THEORETICAL AND EXPERIMENTAL INVESTIGATIONS [ENTWICKLUNG EINES MECHANISCHEN ANTENNENENTDRALLUNGSSYSTEMS. TEIL 3: WEITERFUEHRUNG DER THEORETISCHEN UND EXPERIMENTELLEN UNTERSUCHUNGEN]

M. Granzow, G. Hauser, G. Sinreich, and H. R. Treffon Feb. 1970 68 p refs In GERMAN; ENGLISH summary Sponsored by Bundeshin. fuer Bildung und Wiss.
(BMBW-FB-W-70-06) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich. 13.90 DM

Power input, variations of operating characteristics, and the consumption of lubricants are the most important criteria for the applicability of bearings at alternating temperatures under space conditions. These parameters are investigated during endurance tests in ultrahigh vacuum by means of an oil vapor lubricated bearing. The development and construction of a flappable parabolic antenna for a spinstabilized communication satellite is described and the flap mechanisms and actuator for the deployment are investigated in detail. Author (ESRO)

N70-27642*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF OPERATING PARAMETERS ON NET POWER OUTPUT OF A 2- TO 10-KILOWATT BRAYTON ROTATING UNIT
Robert Y. Wong, Hugh A. Klassen, Robert C. Evans, and Charles H. Winzig Washington May 1970 18 p refs
(NASA-TN-D-5815; E-5527) Avail: CFSTI CSCL 10B

The Brayton rotating unit was operated as part of a closed laboratory loop over a wide range of operating parameters. The operating parameters included compressor outlet pressure (15.0 to 45.0 psia), inlet temperature to the turbine (1460 deg to 2060 R or 811 to 1144 K), inlet temperature to the compressor (510 deg to 580 R or 283 to 322 K), and molecular weight, which varied the aerodynamic speed from 69 to 100 percent of design. Author

N70-27687# California Univ., Los Angeles. Dept. of Energy and Kinetics.
NONAQUEOUS ELECTROLYTE STUDIES FOR HIGH ENERGY BATTERIES Final Report, 1 Jul. 1966 – 13 Oct. 1968
Douglas N. Bennon Sep. 1969 6 p refs
(Contract N123(62738)57439A)
(AD-701411) Avail: CFSTI CSCL 10/3

A very brief summary is given work on the electrochemical reduction of meta-dinitrobenzene in dimethyl sulfoxide and in liquid ammonia solutions. Also mentioned is research pertaining to electrochemical cells with relatively high potential formed using a lithium negative and graphite positive in dimanthyl sulfite and propylene carbonate solutions. It was believed that the positive electrode reaction involves the formation of a lamellar compound of graphite with the electrolyte anion. TAB

N70-27706*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation Lab.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: ACCEPTANCE TEST OF McDONNELL-DOUGLAS, ASTROPOWER DIVISION 5.0 AMPERE-HOUR SILVER-ZINC CELLS
J. D. Harkness 9 Apr. 1970 28 p
(NASA Order W-12397)
(NASA-CR-109873; QE/C-70-294) Avail: CFSTI CSCL 10C

Ninety-eight Astropower 5.0 ampere-hour cells were received for evaluation of the inorganic separator in various test programs such as the synchronous, IMP, and 90-minute life cycling orbits, the constant potential, 120 percent recharge, and the 30-day stand separator tests. Prior to the placement of the cells on the test programs, they were evaluated for physical defects, seal quality, and ampere-hour capacity as outlined in the acceptance procedure. The test results show leakage in 82 cells prior to the capacity tests and in 80 cells after the capacity tests; 41 cells failed to deliver the required capacity of 5.5 ampere-hours. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N70-28545# Radiobiological Inst. TNO, Rijswijk (Netherlands).
MEASUREMENTS OF ABSORBED DOSES DUE TO EXPOSURE OF ORGANS OF DIFFERENT COMPOSITION TO FAST NEUTRONS OF DIFFERENT ENERGIES Final Report
J. J. Broerse and G. W. Barendsen Brussels EURATOM 1970 28 p refs
(Contract EURATOM-065-66-10 BION)
(EUR-4465.e) Avail: CFSTI

The absorbed dose in cells exposed to fast neutrons will depend on their atomic composition and on the composition of the materials surrounding the cells. Large dose variations may therefore occur at the interface of different tissues. The perturbations of secondary particle equilibrium at such interfaces were investigated with an ionization chamber and a cell culture system. In view of the complex character of the energy dissipation by fast neutrons, the variations in absorbed dose and in biological damage were first studied for the most extreme situations, i.e. cells adjacent to material containing no hydrogen at all or material containing the maximum amount of hydrogen which is found in some mammalian tissues. However, in the irradiation of an intact animal the variations will be smaller. In subsequent experiments the variations in absorbed dose and biological effects, resulting from the same exposure, were studied for cells directly adjacent to bone and for cells surrounded by soft tissue. For X irradiations and 15 MeV neutron irradiations survival curves were determined for cells irradiated on muscle-equivalent plastic and on bone-equivalent plastic. These results were related to the occurence to the bone-marrow syndrome and the intestinal syndrome in mice after neutron and X irradiation. Author

N70-28629# Edgerton, Germeshausen and Grier, Inc., Goleta, Calif.
MULTIPLE-SOURCE ARRAYS FOR LARGE-AREA IRRADIATION Technical Report
W. Quam and C. Rainbolt Mar. 1969 24 p refs
(Contract AT(29-1)-1183)
(EGG-1183-2205; TR-S-450-R) Avail: CFSTI

Irradiation systems capable of providing a uniform dose rate over relatively large land areas are required for investigating the ecological effects of ionizing radiation on plants and small animal populations. In this study, simple computational methods were used to obtain approximations of the effectiveness of multiple-source arrays made up of Co-60 and Cs-137 sources atop thin poles spaced at regular intervals. Dose rate distributions, efficiencies, and figures of merit are presented in tabular and graphical form for two basic array configurations and ninety different source-height and spacing arrangements. Author (NSA)

N70-28650*# National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY; A CONTINUING BIBLIOGRAPHY WITH INDEXES
Mar. 1970 152 p refs
(NASA-SP-7011(74)) Avail: CFSTI CSCL 06E

In its subject coverage, 'Aerospace Medicine and Biology' concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors

receive appropriate attention. In general, emphasis will be placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion. This is the March 1970 edition. Author

N70-26851*# National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Dec. 1969 164 p refs
(NASA-SP-7011(70)) Avail: CFSTI CSCL 06E

In its subject coverage, 'Aerospace Medicine and Biology' concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology and personnel factors receive appropriate attention. In general, emphasis will be placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion. This is the December 1969 edition. Author

N70-26838# Louisville Univ., Ky. Performance Research Lab.
RESEARCH IN PERFORMANCE ASSESSMENT AND ENHANCEMENT Interim Technical Report
Earl A. Alluisi Aug. 1969 27 p refs
(Contracts DAHC19-69-C-0009; DA-49-193-MD-2567)
(AD-701089; ITR-69-12) Avail: CFSTI CSCL 5/10

Results of prior studies on work behavior are presented and interpreted with regard to the equivalence of different durations of work, depending on the constraints and demands of the non-work or rest periods of the work-rest schedule; the effects on performance of the underlying psychophysiological diurnal rhythms and certain characteristics of such rhythms; the combined effects of sleep loss and demanding work-rest schedules; and the effects of infectious diseases on work behavior. Author (TAB)

N70-26869# School of Aerospace Medicine, Brooks AFB, Tex. Environmental Systems Div.
GROWTH POTENTIAL OF RADISH IN A CONTROLLED ENVIRONMENT Final Report, 1968–1969
Syrrel S. Wilks Nov. 1969 17 p refs Submitted for publication
(AD-700741; SAM-TR-69-72) Avail: CFSTI CSCL 6/3

Under optimized conditions (culture chamber and plant-supportive matrix, nutrients, elevated P(CO2), continuous light, etc.) the radish plant can produce significantly large masses of edible plant material in a relatively short period of time. Certain strains of radish (HV White Icicle and Chinese Celestial) have yielded 10 to 12 liters O2/(sq m)(hr) at 15 through 35 days postplanting. At 30 days the dry weight yield (tuberous roots plus foliage) was 2.5 kg/sq m or a daily average of 82.5 gm/sq m. The food value of the total dry plant material was approximately 3 kcal/gm or 247.5 kcal/sq m 1 day. Cyclic growth of 4 to 5 sq m could provide the O2 requirements of one man, and an increase in planted surface to 8 to 10 sq m would provide the caloric requirement of one man and the O2 requirement of 2 to 3 men. This approach should provide background information for the possible utilization of plant systems in aerospace missions of extended duration. Author (TAB)

N70-26960 National Lending Library for Science and Technology, Boston Spa (England).
ACCELERATED METHODS OF STUDYING BIOCHEMICAL PROPERTIES OF BACTERIA [USKORENNYE METODY IZUCHENIYA BIOKHIMICHESKIKH SVOISTV BAKTERII]
Yu. B. Popov Feb. 1970 6 p refs Transl. into ENGLISH from Lab. Delo (Moscow), v. 10, 1967 p 621 624
(RTS-5581) Avail: Natl. Lending Library, Boston Spa, Engl.: 10s or 1 NLL photocopy coupons

Rapid and economical micromethods were used for splitting urea, forming indole, and fermenting carbohydrates. Typical cultures of Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Bacillus cereus, Bacillus mesentericus, Micrococcus pyogenes var. aureus, and Bacillus megatherium were used in the experiments. R.B.

N70-26968# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
INFORMATION AND DATA USED IN EVENT OF AN ACCIDENT [INFORMATIONS ET DONNEES UTILES EN CAS D'ACCIDENT]
H. Jammet [1969] 5 p In FRENCH Presented at the Symp. on the Handling of Radiation Accidents, Vienna, Austria, 19-23 May 1969
(CEA-CONF-1337; CONF-690509-5; SM-119/51) Avail: AEC Depository Libraries

An inventory of essential data both in the physics and in the medical domains is presented. The physics information covers the nature, modality, and importance of the irradiation for accidental external irradiation and radioactive contamination. The medical information covers diagnostic, therapeutic, and prognostic data for accidental external irradiation and for accidental radioactive contamination. NSA

N70-27042# School of Aerospace Medicine, Brooks AFB, Tex.
PHYSICAL-CHEMICAL ASPECTS OF BUBBLE FORMATION Final Report, Feb. 1968–Jun. 1969
Kenneth G. Ikels Oct. 1969 16 p refs
(AD-700730; SAM-TR-69-60) Avail: CFSTI CSCL 6/19

Biophysical concepts regarding the production and growth of bubbles in gas-supersaturated solutions were considered with reference to the problem of decompression sickness. It was demonstrated that solutions, including blood, which are free of gas nuclei do not form bubbles in response to decompression alone, despite the presence of large amounts of dissolved gas. Such findings emphasize that the comprehensive understanding of decompression sickness requires elucidation of the basic physical-chemical factors responsible for cavitation or initiation of nuclei in solutions. Observations were made on a mechanism for producing nuclei by continuous contact and separation of surfaces (tribonucleation). Unlike several other possible mechanisms, tribonucleation was shown to be capable of producing nuclei from which bubble growth occurs under the relatively mild experimental conditions that can be encountered in vivo. Author (TAB)

N70-27048*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Space Sciences Div.
SURVIVAL OF MICROORGANISMS IN DESERT SOIL EXPOSED TO FIVE YEARS OF CONTINUOUS VERY HIGH VACUUM
R. E. Cameron, F. A. Morelli, and H. P. Conrow 15 Mar. 1970 16 p refs
(Contract NAS7-100)
(NASA-CR-109763; JPL-TR-32-1454) Avail: CFSTI CSCL 06M

Survivability of indigenous aerobic, anaerobic, and microaerophilic bacteria, fungi, algae, and protozoa occurring as a microbial community in a desert algal soil crust was determined after 4 to 5 years of exposure to continuous very high vacuum. Aerobic and microaerophilic bacteria show some decrease in survivability (approximately 1 log unit) after 4 and 5 years. In the sieved and powdered samples, there were not survivable thermophiles after 4 years and the number of algae were reduced from 1,000,000 to 100 per g of soil. No protozoa survived after 5 years in vacuum, but they did survive after 4 years. In the sieved sample, viable microaerophilic bacteria had decreased from 1,000,000 to 100,000 per g of soil, and there were no survivable

anaerobes or molds. Results of survivability of microorganisms in powered samples were more variable than in sieved samples. The reduction in abundance of various groups of microorganisms exposed to vacuum shows some similarity to survivable microbial groups occurring in the naturally harsh, cold Antarctic desert. Author

N70-27053# Bernice P. Bishop Museum, Honolulu, Hawaii.
STUDIES OF AIR-BORNE ORGANISMS RETRIEVED BY LARGE AIRCRAFT Final Technical Report, 1 Feb. 1967–31 Jul. 1969
Linsley J. Gressitt and Eugene Holzapfel Jul. 1969 17 p refs
(Contract AF-AFOSR-1240-67)
(AD-701440; AFOSR-70-0334TR) Avail: CFSTI CSCL 6/3

The main objective of the studies was to operate a trapping program, utilizing an air plankton retriever and other special collecting devices installed in a WV-2 aircraft of the Pacific Missile Range Facility, based at Pt. Mugu, California, for the purpose of collecting all types of air-borne organisms and particles in the Pacific area. The primary interest was trapping air-borne arthropods to further test the theory of natural air dispersal of arthropods to oceanic islands. TAB

N70-27123# Oakland Univ., Rochester, Mich. Inst. of Biological Sciences.
KINETICS OF PUMP-LEAK SYSTEM OF TRANSPORT IN THE OCULAR LENS, DERIVED FROM CLASSIC ENZYME KINETICS AND DIFFUSION THEORY
Ian Mc Lean, V. Everett Kinsey, and Richard Conley La Force (Mayo Found.) [1969] 16 p refs
(Contract AT(11-1)-2012; Grant NIH NB-08339)
(COO-2012-1) Avail: CFSTI

A relationship is derived between the transfer coefficient of the pump and the concentration of substrate and inhibitor ions in the media using classic Michaelis–Menten kinetics. The leak is described not only in terms of the chemical gradient but of the electric gradient and permeability characteristics of the lens as well. A method is outlined whereby these relationships can be used to interpret lens culture data in terms of the various pump and diffusion parameters. Author

N70-27124# Georgia Univ., Athens. Dept. of Biochemistry.
ENERGY TRANSFER IN CHEMICAL AND BIOLOGICAL SYSTEMS Final Report, 1964–1969
John Lee 1969 12 p refs
(Contract AT-(30-1)-3401)
(NYO-3401-6) Avail: CFSTI

Chemiluminescence of luminol, bioluminescence of bacteria, and bioluminescence of marine dinoflagellates were studied. Although some of the bacterial work was done on in vivo systems this work did not progress as rapidly as the in vitro studies which are now being prepared for publication. The dinoflagellate study was in vivo and was much more successful. Funding reduction however required curtailment of this program in midstream. A study of the luminescence properties of protein was also made and although no direct publication resulted it provided a firm foundation for the spectral study of bacterial luciferase. Author

N70-27138*# Mayo Association, Rochester, Minn.
STUDIES OF THE EFFECTS OF GRAVITATIONAL AND INERTIAL FORCES ON CARDIOVASCULAR AND RESPIRATORY DYNAMICS Semiannual Status Report, 1 Nov. 1968–1 Nov. 1969
1 Oct. 1969 35 p refs
(Grant NGR-24-003-001)
(NASA-CR-109727) Avail: CFSTI CSCL 06S

Accomplishments of the continuing study are reported and include the following: (1) The operational readiness was completed of a biplane X-ray image intensifier video system plus a video quantizer and flying-spot scanner assembly for electronic recognition and measurement of the diameters of the opacified left ventricular chamber at each horizontal line of its biplane video image. In addition, techniques were developed for the transfer of data from this system to the juxtaposed CDC 3200 computer and the processing of these data. (2) The use of telemetered flow pulses for ultrasonic flowmeters chronically implanted on the right, left, and main pulmonary arteries for the study of the effect of the direction and magnitude of the force environment on the distribution of pulmonary blood flow was attempted in three dogs. (3) Progress continued on the development of the computer controlled scintiscanning system and associated computer processing techniques for study of regional distribution of blood flow. (4) An investigation was conducted on the effects of breathing liquid fluorocarbons on regional differences in intrathoracic pressures, pulmonary blood flow, and blood oxygenation. D.L.G.

N70-27180# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
THE EFFECT OF PHYSICAL FITNESS ON THE WORK CAPACITY AT ALTITUDE [DER EINFLUSS DES TRAININGSZUSTANDES AUF DIE KOERPERLICHE LEISTUNGSFAEHIGKEIT IN DER HOEHE]
Arno Rimpler (Ph.D. Thesis—Bonn Univ.) Mar. 1970 77 p refs
In GERMAN; ENGLISH summary
(DLR-FB-70-08) Avail: CFSTI: Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 21,40 DM

In 12 healthy, untrained students physical performance was evaluated at a total pressure of 750 mm Hg, 578 mm Hg, and 515 mm Hg with a stepwise increasing work load on a bicycle-ergometer. The results were compared with those obtained under the same conditions from a group of 12 highly trained athletes. At an altitude of 2,250 m both groups did not differ significantly in their hypoxia induced alterations of heart rate, breathing volume, oxygen uptake, oxygen pulse, ventilation equivalent and respiratory quotient—except, however, the maximal values of respiratory volume and oxygen uptake. The reduction of the highest possible duration and quantity of work was significantly more marked in athletes than in non-athletes, the observed reduction of the corresponding maximal oxygen uptake being 10.1% and 8.7%, respectively. For the correlation between the aerobic work capacity and its reduction under hypoxia a positive coefficient ($r = 0.82$) was found which was statistically significant. Furthermore, utilizing our own data and data from the literature, correlation was calculated between performance reduction and altitude in the range of 2,000 to 4,000 m separately for both groups. With increasing altitudes the regression lines show a progressively higher increment of performance reduction in athletes than in non-athletes. Author (ESRO)

N70-27227# Johns Hopkins Univ., Baltimore, Md. Dept. of Psychology.
THE EVOLUTION OF PERCEPTUAL FRAMES OF REFERENCE Technical Report
Howard Egeth, William Beven, Stanley C. Collyer, and John Jonides Feb. 1970 107 p refs
(Contract N00014-67-A-0163-0001)
(AD-702478; TR-61; TR-62) Avail: CFSTI CSCL 5/10

The purpose is to provide an up-to-date account of the empirical and theoretical status of the concept of attention, with emphasis on the selective and intensive properties of attention that are manifested in studies of human perceptual processes. Author (TAB

N70-27296*# Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N.Mex.
EXPOSURE LIMITS FOR CHIMPANZEES AT NEAR VACUUM

FOLLOWING RAPID DECOMPRESSION Final Report, Jul. 1964 - Dec. 1968

Alfred G. Koestler, ed. Dec. 1969 92 p refs

(NASA Order T-61022-G)

(NASA-CR-108444; ARL-TR-69-6) Avail: CFSTI CSCL 06S

Six chimpanzees were decompressed from 179 mm Hg (breathing 100 percent oxygen) to less han 2 mm Hg in 0.8 seconds and remained at this pressure altitude 180 or 240 seconds. Following repressurization within 30 seconds, using 100 percent oxygen, to 179 mm Hg, subjects were maintained at this pressure altitude for a minimum of 4 hours. Four subjects did not survive the experimental conditions. Results of these decompressions demonstrate that a 3-minute tenure at near vacuum constitutes the maximum safe exposure limit. Complex behavioral tasks, physiological parameters (ECG, respiration, and skin temperature) cortical and deep implant EEG data, as well as detailed physical examinations seem to confirm previous findings, that exposure to near vacuum either results in death or in complete recovery with no apparent long term detrimental effects as determined by behavioral tasks. Author

N70-27370*# Webb Associates, Malibu, Calif.

LIMITS OF ENDURANCE FOR HEAT STRESS ARISING FROM WORK WHILE TOTALLY INSULATED

Herman P. Roth and W. Vincent Blockley Apr. 1970 79 p refs

(Contract NAS9-8871)

(NASA-CR-108419) Avail: CFSTI CSCL 06S

Ten healthy, physically-fit male subjects, ranging in age from 23 to 39 years, walked on a treadmill in an environmental chamber, at four incremental levels of energy expenditure, in a clothing/environment combination which assured near-zero heat exchange and compelled storage in the body of all metabolically-produced heat. Each test was carried to the limit of the subject's endurance, at which time he was rapidly cooled. Heart rate and temperatures of the ear canal, rectum, and 9 skin surface locations were continuously recorded, and oxygen uptake was continuously monitored. Great differences in tolerance time at each metabolic level were found, which were not correlated with physical fitness as measured by a standard work tolerance test given each subject three times during the program. Rate of rise of ear canal temperature proved to be the best predictor of average tolerance time. Judged by increase in mean body temperature, heat storage of about 1000 Btu in the high-tolerance group of 5 men, and about 800 in the low-tolerance group of 5, brought subjects near to the collapse point, though some tolerated as much as 1400 Btu increase in body heat content. These storage tolerance values for exercising subjects are from about 50 to 100% higher than an average of 584 Btu determined in a previous study of seated subjects in very hot environments. It appears that the difference may represent the change in heat content which is normally associated with the change to a new thermal equilibrium during the first hour of work in a moderate to warm climate. Author

N70-27375# Aerospace Medical Lab. (Clinical), Lackland AFB, Tex.

MOL BIOMEDICAL CREW MEASUREMENT PROGRAM: HEMATOLOGIC MEASUREMENTS Technical Report, Jan. - Jun. 1968

Charles A. Coltman, Jr. Mar. 1969 31 p refs

(AD-701041; AMLC-TR-69-4) Avail: CFSTI CSCL 6/19

Space flight is associated with alterations in red cell, white cell and plasma protein composition, but the exact mechanism involved is unknown. Each parameter is exposed to a large variety of stresses, any of which could conceivably act independently, in an additive manner, or even synergistically to produce changes observed thus far. The potential stresses that may influence hematologic homeostasis during manned space flight are weightlessness, atmosphere, transverse acceleration forces, vibration, irradiation and exercise. Complete bed rest is the best available experimental model to test mans potential response to zero gravity. A detailed analysis of the available literature revealed that methodologies differed, but the investigators obtained strikingly consistent results. The red cell mass decreased erythropoiesis. However, data on the Gemini IV, V and VII astronauts suggested need for identifying another mechanism. Use of the diisopropylfluorophosphonate 32 technique to measure survival of erythrocytes is recommended for experiments simulating space flight conditions, because it is more accurate than chromium 51 and other methodologies used. For short-term studies, use of endogenous carbon monoxide production is recommended to approximate more closely the rate of destruction of erythrocytes. Author (TAB)

N70-27377*# Agence Tunisienne de Public-Relations, Tunis.

THE DEPENDENCE OF SLEEP MOVEMENTS OF PHASEOLUS MULTIFLORUS ON VARIOUS OTHER EXTERIOR FACTORS [DIE ABHAENGIGKEIT DER SCHLAFBEWEGUNGEN VON PHASEOLUS MULTIFLORUS VON VERSCHIEDENEN AUSSENFAKTOREN]

Rose Stoppel Washington NASA May 1970 89 p refs Transl. into ENGLISH From Z. Botan. (Stuttgart), v. 8, 1916 p 608 - 684 Prepared for NASA and NSF

(NASA-TT-F-12613; TT-70-58014) Avail: CFSTI CSCL 06C

The results of the experiments with Phaseolus leaves cultivated in darkness were absolutely identical, by the fact that the leaves reached their lowest position in the early morning hours, between 2:00 a.m. and 4:00 a.m., and showed a periodicity of 24 hours in their movements. Normal leaves would never obtain the height of their downward movement at noon or in the evening hours. The momentaneous fixation of the movement cannot be based on a hereditary periodicity. Light and temperature change were eliminated as potential factors able to regulate the movements and changes of humidity and air pressure are without visible influence on the movements. Only the very small day-periodical oscillations of the earth's gravity or the electrical phenomena in the atmosphere could possibly have an influence in this direction. The result is the circular movement of energy in the plant. Author

N70-27409# Antioch Coll., Yellow Springs, Ohio. Behavior Research Lab.

THE PHYSICAL CHARACTERISTICS AND FACTOR STRUCTURE OF A SELECTED SET OF RANDOM SHAPES

Ronald L. Knoll and Herbert J. Clark (AMRL, AFSC) Jun. 1969 29 p refs

(Contract F33615-67-C-1260)

(AD-702517; AMRL-TR-69-8) Avail: CFSTI CSCL 5/10

One hundred and twenty uncurved random shapes frequently used in studies of form perception are described in terms of 12 nearly orthogonal physical measures of shape. Calculation of the measures is described and their unique characteristics are pointed out. Although random shapes were examined in this investigation, techniques developed and conclusions arrived at are equally relevant to the specification of some of the characteristics of targets in the real world. Author (TAB)

N70-27483# Innsbruck Univ. (Austria). Inst. fuer Psychologie.

INVESTIGATIONS INTO THE ADAPTATION OF CONTOUR-DETECTORS IN THE HUMAN VISUAL SYSTEM THROUGH ANALYSIS OF AFTERIMAGES OF ALTERNATING STIMULUS PATTERNS

Gerhard Luecke 1968 32 p refs

(AD-698882) Avail: CFSTI CSCL 5/10

Following a brief introduction into some recent results of psychophysical and neurophysiological studies of contour-perception, a new situational aftereffect, which shows binocular interaction, is reported. It is shown that alternating stimulation with two gratings, consisting of parallel black and white stripes, results after each stimulus in alternating afterimages, and that the latency of the first of these afterimages is a function of the orientation of the two

gratings. After reporting some further new afterimage phenomena connected with this situational aftereffect, the findings are discussed in relation to some aspects of information-processing in the human visual system. Author (TAB)

N70-27472*# Sandia Corp., Albuquerque, N.Mex. Planetary Quarantine Applied Science Div. 1742.
THE FEASIBILITY OF THERMORADIATION FOR STERILIZATION OF SPACECRAFT A Preliminary Report
Marcel C. Reynolds Dec. 1969 24 p refs
(NASA Order W-12853)
(NASA-CR-109871; SC-RR-69-857) Avail: CFSTI CSCL 06M

Initial tests indicate that, utilizing relatively low levels of heat and radiation, the technique provides effective bacterial sterilization. The applicability of the technique to a selection of other resistant bacteria, the optimization of temperature/radiation exposures, and the effectiveness on actual spacecraft hardware are listed for future study. Author

N70-27475# Tennessee Univ., Oak Ridge. U-T-AEC Agricultural Research Lab.
[RESEARCH ACTIVITIES] Annual Progress Report, 1 Jan. - 31 Dec. 1968
Oct. 1969 191 p refs
(Contract AT-40-1-GEN-242)
(ORO-672) Avail: CFSTI

Research activities covered the general groups of prenatal studies, reproduction, late effects, early effects, metabolism, soil chemistry, plant studies, laboratory herd health, and pathology. A bibliography is also provided. NSA

N70-27504 National Lending Library for Science and Technology, Boston Spa (England).
CLINICAL SYMPTONS OF ACUTE ATTACKS BY SUPER HIGH FREQUENCY ELECTROMAGNETIC WAVES
F. A. Kolesnik et al [1969] 7 p refs Transl. into ENGLISH from Voenno-Med. Zh. (Moscow), no. 4, Apr. 1967 p 21 23
(NLL-Trans-2628-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 photocopy coupons

Two cases of acute attacks by high intensity super high frequency electromagnetic waves are examined. Cause, symptons, treatment, and response of the patients were noted. X-rays, blood analysis, EEG, blood pressure, cholesterol, glycaemia coefficients, and the Quick's test data are reported. S.S.

N70-27533# Battelle Memorial Inst., Columbus, Ohio.
A PRELIMINARY MATHEMATICAL MODEL FOR PREDICTING THE TRANSPORT OF RADIONUCLIDES IN THE MARINE ENVIRONMENT
S. G. Bloom and G. E. Raines 20 Nov. 1969 20 p refs
(Contract AT(26-1)-171)
(BMI-171-123) Avail: CFSTI

Expressions for the internal radiation dose to standard man following the consumption of sea foods are derived. The potential internal radiation dose is discussed and compared with radiation protection guides to determine the necessity of radiological safety measures. The model derivation starts with an instantaneous point source solution to a partial differential equation of the physical dispersion process in the ocean. An expression for the radionuclide concentration in the ocean resulting from a fallout input is developed and indicates that vertical diffusion is the controlling mechanism for dispersion soon after the fallout deposition, and that convection controls dispersion later. Simpler expressions for describing dispersion of a fallout input are used to define a mixing volume which then is considered to be the receptor of both the fallout and the terrestrial radionuclide inputs, which are due to direct ground water contamination and terrestrial fallout. An expression is derived for the radionuclide concentration in the mixing volume which is combined with a seawater-seafood-man food-chain model to arrive at expressions for the infinite internal radiation dose to man. Author (NSA)

N70-27543# Albert Einstein Medical Center, Philadelphia, Pa.
[STUDY OF THE IN VITRO EFFECTS OF IONIZING RADIATION ON GERMINAL EPITHELIUM OF HUMAN TESTIS AND ON STEROID BIOSYNTHESIS OF LEYDIG CELLS, UTILIZING TISSUE CULTURE METHODS] Progress Report
[1969] 27 p
(Contract AT(30-1)-4034)
(NYO-4034-1) Avail: CFSTI

Methods of preparing histologic sections of tests for radio-autography are described. Cultures of fresh tissue were exposed to 225 R of gamma radiation and tissues were fixed at intervals from 24 hr to 10 weeks later. Cytological changes in germinal cells are described and photographs of typical cells are presented. From the fourth to the tenth week there was a gradual decline in the total cell count affecting both spermatogonia and the Sertoli cells. A discussion is presented of relative degeneration and proliferation of spermatogonia, spermatocytes, and spermatids. Studies were conducted on effects of in vitro irradiation on steroid biosynthesis in Leydig cells. NSA

N70-27573# Michigan Univ., Ann Arbor. Dept. of Psychology.
HUMAN INFORMATION HANDLING PROCESSES Semiannual Report, 1 Jun. - 30 Nov. 1969
Arthur W. Melton Dec. 1969 33 p refs
(Contract AF 49(638)-1736; ARPA Order 461)
(AD-702475; MR-11; AFOSR-70-0774TR; Rept-08773-55-SA) Avail: CFSTI CSCL 5/10

This is a semi-annual report of research carried out on human performance in information processing and memory at the Human Performance Center, Department of Psychology, University of Michigan, under Contract No. AF 49(638)-1736. The report lists 13 publications and 3 in press articles that are products during the 6 month period 1 Jun 1969 to 30 Nov 1969. Recent accomplishments and future plans are summarized under the headings: Selective information handling, Information storage and retrieval (memory). TAB

N70-27574# Michigan Univ., Ann Arbor. Sensory Intelligence Lab.
STATISTICAL DECISION PROCESSES IN RECOGNITION AND DETECTION Final Report
Wilson P. Tanner, Jr. Feb. 1970 15 p
(Contract F44620-68-C-0090)
(AD-702477; AFOSR-70-0783TR; Rept-01774-1-F) Avail: CFSTI CSCL 5/10

The report summarizes research on measurement of the time involved in input data processing and decision making in psychoacoustics, the acquisition of sensory abilities, sensory function in multimodal signal detection, the processing of complex inputs over multiple channels, and binaural masking. Author (TAB)

N70-27739# Columbia Univ., New York. Dept. of Biochemistry.
THE EFFECT OF CHEMICAL MODIFICATION OF DNA ON ITS MACROMOLECULAR STRUCTURE Progress Report, 1 May 1969 - 31 Jan. 1970
Alvin I. Krasna 1970 9 p refs
(CU-3957-6) Avail: CFSTI CSCL 06A

Results for the denaturation by acid, alkali, and heat are described. Besides elucidating the mechanism of denaturation, these results confirm previous findings on native DNA that high angle scattering (> 30 deg) measurements underestimate the molecular weight of the native material by at least a factor of two. The low angle curvature observed with native DNA is shown to be an inherent property of the molecule and not due to experimental

artifacts. In all the denaturation studies, it was found that the molecular weight decreased by somewhat more than a factor of two which is in contrast to all previous high angle light scattering studies from other laboratories which reported no change in molecular weight on denaturation. Author

N70-27751# Buenos Aires Univ. (Argentina). Facultad de Medicina.
RADIATION DAMAGE TO THE ELECTROCHEMICAL AND BIOCHEMICAL ACTIVITIES OF MUSCLE MEMBRANE Final Progress Report, 1 Apr. 1968 - 31 May 1969
Carlos Perez 31 May 1969 94 p refs
(Contract AT(30-1)-3467)
(NYO-3467-2) Avail: CFSTI

This research work is divided into two major approaches for studying the effects of radiation on membrane organization and functions: biophysical properties of the electrical and chemical excitable membranes and biochemical studies of the organized membranes, including the cell membrane, mitochondrial and microsomal membranes. In experimental animals with distinct differences in radiosensitivity, (rats and frogs) it is possible to ascertain some of the elements involved in biological responses to ionizing radiation. The goal of this research can be indicated by the work in progress during the recent years: membrane systems and control mechanisms; maintenance of membrane systems; the vectorial character of membrane systems; the permeability of membrane systems; membranes and metabolic sequences; and modification of the form of complexes by action of enzymes, activators, inhibitors, blocking agents and radiation. Author (NSA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N70-28505*# Perkin-Elmer Corp., Pomona, Calif.
TWO GAS ATMOSPHERE SENSOR SYSTEM (MASS SPECTROMETER), PHASES 2a AND 2b, JUNE 1966 - MARCH 1969
Washington NASA Apr. 1970 592 p refs
(Contract NAS1-6387)
(NASA-CR-1546) Avail: CFSTI HC$10.00 CSCL 20F

This report covers the two principal phases of an effort to design, fabricate, and test a mass spectrometer in a miniaturized, flight prototype configuration. The report is divided into two parts: (1) the design of the sensor and the fabrication of an Engineering Test Model (ETM) to demonstrate the correctness of the overall sensor design; and (2) the fabrication and acceptance testing of four sensors, subsequently modified to incorporate additional design, fabrication, and test efforts for a ball leak inlet system, a miniaturized ion pump, and the installation of one of the instruments on a 4-man, 60-day closed chamber test for monitoring and control of the atmosphere within the chamber. Included is the basis for the design, details of the modified reliability and quality assurance efforts, details of the fabrication and assembly, drawings of the components and electronic subsystems, and results of the acceptance testing accomplished. Author

N70-28884*# GCA Corp., Bedford, Mass.
STUDY OF THE APPLICATION OF A PHOTOIONIZATION MASS SPECTROMETER TO ANALYSIS OF CONTAMINANT GASES, JUNE 1966 - NOVEMBER 1969
Peter Warneck, J. N. Driscoll, and C. Matthews Washington NASA May 1970 68 p refs
(Contract NAS1-7764)
(NASA-CR-1589; GCA-TR-69-10-N) Avail: CFSTI CSCL 20F

Thirty-two gases and vapors were investigated with the photoionization mass spectrometer described previously. Fragmentation patterns were determined at four ionizing wavelengths: 803, 950, 1048, and 1216 A, respectively, making use of strong line sources. The possibility of discriminating between isometric substances by varying the wavelengths was found to exist for the butenes, and butylalcohols, but not for the xylenes. In addition to fragmentation patterns, the mass spectrometric sensitivities and detection limits were determined to evaluate the potential of the photoionization mass spectrometer technique for trace gas analysis. It is shown that with presently available light sources average detection limits are about 10 ppm, in agreement with previous results. As assessment is made to show that the detection limits can be improved. Finally, the feasibility of utilizing photoionization mass spectrometry for the analysis of space cabin atmospheres, using solar ionizing radiation, is demonstrated. Author

N70-28581*# Stanford Research Inst., Menlo Park, Calif.
AWAKENING EFFECTS OF SIMULATED SONIC BOOMS AND SUBSONIC AIRCRAFT NOISE ON SIX SUBJECTS, 7 TO 72 YEARS OF AGE
Jerome S. Lukas and Karl D. Kryter Washington NASA May 1970 62 p refs
(Contract NAS1-7592)
(NASA-CR-1599) Avail: CFSTI CSCL 06S

Six persons aged 7, 8, 41, 54, 69, and 72 years were exposed during sixteen experimental nights to simulated sonic booms and recorded noise (101 to 113 PNdB) from a subsonic aircraft. The results, considered tentative because of the small number of subjects, showed that the oldest subjects were awakened about 70% of the time by sonic booms, and about 45% of the time by the subsonic aircraft noise; the middle-aged group were awakened about 3% of the time by booms, and 7% of the time by the noise; the children were not awakened by the boom, and about 2% of the time by the aircraft noise. Author

N70-28590# System Research, Ltd., Richmond (England).
RESEARCH INTO THE ADAPTIVELY CONTROLLED INSTRUCTION OF COMPENSATORY TRACKING SKILLS Final Scientific Report
Gordon Pask and B. C. E. Scott Oct. 1969 66 p refs
(Contract F61052-68-C-0071)
(AD-698817; AFOSR-69-3086TR) Avail: CFSTI CSCL 5/9

The report describes a number of experiments designed to compare the acquisition of a compensatory tracking skill in adaptively controlled and open loop conditions. It covers one dimensional tracking and two dimensional tracking. Several one dimensional tasks were employed in order to control the degree of subskill interference and memory load. Typical learning curves for the principal conditions are presented. Author (TAB)

N70-28693# Akademiya Nauk URSR, Kiev.
PORTABLE HYDROACOUSTIC TRANSMITTER FOR TRACKING TAGGED FISH
G. N. Vasilyev, D. V. Zdanevich, S. M. Kidun, and V. M. Saroyge *In its* Appl. Acoustics and Vibration Technol. 1968 p 125-129 refs In RUSSIAN (See N70-28676 13-34)
Avail: CFSTI

The measurement circuit and design of the transmitter are described. The transmitter is intended for studying the migration routes of Volga sturgeon and their behavior near dams and hydraulic installations. The transmitter is saddle-shaped and made of lightweight plastic. It is fastened directly to the body of the fish. Transl. by H.W.

N70-28728# Illinois Univ., Urbana. Biological Computer Lab.
ANALYSIS AND SYNTHESIS OF COGNITIVE PROCESSES AND SYSTEMS Final Report, 1 Sep. 1967 - 31 Aug. 1969

Heinz Von Foerster 15 Dec. 1969 209 p refs
(Grant AF-AFOSR-7-67)
(AD-701072; AFOSR-70-0319TR) Avail: CFSTI CSCL 6/4

The study aims at the comprehension of cognitive processes on three levels: (i) An epistemology of cognitive processes which has as a goal a rigorous penetration of the logic of descriptions, of the concept of self-reference and of the emergence of sensory modalities. (ii) Theoretical investigations of cognitive processes in terms of mathematical models of complex regulatory and control systems, and of the amount of information that must flow between identifiable parts of such systems in order to maintain its regulatory powers are proposed. (iii) Experimental sutdies in electrophysiology of neural activity along sensory channels, in higher nuclei and in motor control areas of vertebrates are contemplated in as much as they are commensurate with the needs of the epistemological and theoretical investigations. Author (TAB)

N70-28799*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE SUIT HAVING IMPROVED WAIST AND TORSO MOVEMENT Patent Application
Hubert C. Vykukal, inventor (to NASA) Filed 23 Mar. 1970 13 p
(NASA-Case-ARC-10275-1; US-Patent-Appl-SN-21644) Avail: CFSTI CSCL 06K

The improved suit has a rotating joint at the mid region of the torso. The rotary joint is canted at an angle of about 30 degrees to the horizon with the lowest portion of the joint towards the front of the suit. The low-friction rotary joint has a disconnect mechanism. The seal is placed on the outside of balls so as to protect them from dirt and dust. The suit also includes a double bellows in the pelvic region; namely, an upper bellows and a lower bellows joined together by an intermediate portion. By employing the canted rotary joint, many bending and stooping operations are facilitated, particularly those in which one shoulder is normally raised above the other. The double joint in the pelvic portion of the suit gives greater bending freedom so that the suit can conform more nearly to the natural bending and twisting movements of the spine. The invention is equally adaptable to either hard suits or soft suits. NASA

N70-26895# Bunker-Ramo Corp., Canoga Park, Calif.
RESEARCH REQUIREMENTS FOR THE HUMAN ENGINEERING DESIGN OF VISUAL DISPLAYS
Dennis J. Sullivan and David Meister 1 Dec. 1969 31 p refs
(Contract N00014-68-C-0278)
(AD-701790; H0069-9U6) Avail: CFSTI CSCL 5/5

A review was made of all available literature describing the human factors affecting display design. In addition to serving as source material for a handbook, the review was made to indicate areas in which human factors research on display parameters was lacking and should be performed. Author (TAB)

N70-26916# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBABILITY LOGIC CONSTRUCTION OF AN AUTODIDACTIC DIAGNOSTIC PROCESS ON MATHEMATICAL MACHINES
M. L. Bykhovskii 3 Oct. 1969 19 p refs Transl. into ENGLISH from Eksp. Khir. Anesteziol. (USSR), v. 7, no. 1, 1962 p 3–11
(AD-700601; FTD-HT-23-243-68) Avail: CFSTI CSCL 6/5

The paper describes the logic of construction of the diagnostic process, based on probability criteria and the mandatory mathematical relations. It introduces the conception of quality in the work of a diagnostic system. The author considers the organization of an autodidactic system, i.e., of automatic improvement of the quality of the diagnostic progress in an electronic mathematical machine. TAB

N70-26926# Army Natick Labs., Mass. Food Lab.
THE MICROBIOLOGICAL WHOLESOMENESS OF SPACE FOODS
Hamed M. El-Bisi and Edmund M. Powers Jun. 1969 34 p refs
(AD-701861; FL-93; USANLABS-TR-70-41-FL) Avail: CFSTI CSCL 6/8

The microbiological requirements for space foods were established in 1964 to safeguard the health of the astronauts during a space mission. These requirements are: the total aerobic plate count shall not exceed 10,000 per gram; the total coliform count shall not exceed 10 per gram; the fecal coliforms shall be negative in one gram; the fecal streptococci shall not exceed 20 per gram; the coagulase positive staphylococci shall be negative in five grams; and the Salmonellae shall be negative in ten grams of food. During 1967 and 1968, 88 per cent of the space foods tested had total plate counts of less than 10,000 per gram; 98 percent had less than 10 coliforms per gram and 99 percent were negative for fecal coliforms; 86 percent has less than 20 streptococci per gram; and 100 percent were negative for staphylococci and Salmonellae. This report discusses the scientific and technical rationale behind these microbiological requirements. These requirements and the methodology prescribed for determining compliance therewith are documented. Both are under continued review and amendment, in keeping with up-to-date scientific knowledge and technical experience. Author (TAB)

N70-26928# School of Aerospace Medicine, Brooks AFB, Tex. Biomedical Engineering Branch.
TWO ELECTRONIC STETHOSCOPES FOR USE IN HIGH-NOISE ENVIRONMENTS Final Report, May–Nov. 1968
James E. Allred, Homer L. Brammell, and Maureen A. Hunt Oct. 1969 12 p refs
(AD-700734; SAM-TR-69-61) Avail: CFSTI CSCL 6/12

Two electronic stethoscopes were designed for use with litter and ambulatory patients on domestic and overseas aeromedical evacuation flights. The first, a frequency-translating stethoscope, utilizes both a frequency shift of the Korotkoff sounds and the elimination of all acoustic coupling. The second stethoscope, a direct electronic device, eliminates all acoustic coupling. Evaluation in high-noise environments and under actual flight conditions has demonstrated that the instruments are reliable and practicle. The stethoscopes are useful in any noisy area where it is necessary to obtain heart sounds or indirect measurements of blood pressure. Author (TAB)

N70-26987*# Bolt, Beranek, and Newman, Inc., Van Nuys, Calif.
STUDY OF THE AUDIBILITY OF IMPULSIVE SOUNDS
Sanford Fidell and Karl S. Pearsons Washington NASA May 1970 63 p refs
(Contract NAS2-4963)
(NASA-CR-1598) Avail: CFSTI CSCL 06S

Six experiments were performed in an anechoic chamber to investigate the effects of various physical parameters on the perceived noisiness of impulsive signals. The parameters investigated included phase, duration, intersignal interval, repetition, and frequency. All data were collected by a computer based adaptive psychophysical procedure called Parameter Estimation by Sequential Testing (PEST). The experiments show that: (1) the phase spectrum of an impulsive signal is irrelevant to its perceived noisiness, (2) the ear's sensitivity to noisiness of impulsive signals resembles an energy summation process, and (3) the common correction contours may undercorrect in the low frequency regions, and thus should be applied with caution to impulsive signals with appreciable low frequency content (for example, sonic booms). Author

N70-27002# School of Aerospace Medicine, Brooks AFB, Tex.
DESIGN AND PRELIMINARY EVALUATION OF A MAN-RATED PHOTOSYNTHETIC EXCHANGER Interim

Report, Mar. 1967 – Jun. 1968
Richard L. Miller, George W. Rose, III, Herman J. Kilian, Hazel E. Wickline, and Cara L. Martinez Oct. 1969 14 p refs
(AD-700735; SAM-TR-69-64) Avail: CFSTI CSCL 6/11

Algal photosynthesis may be used to provide part of mans expendable needs for life support in long-duration space missions. Feasibility has been demonstrated in model experiments, but the extrapolation of laboratory data to the design of prototype life support systems can only be made within wide limits. The USAF School of Aerospace Medicine has developed a large-scale algal photosynthetic exchanger to study the logistics of operation of a man-rated system. The hardware consists of a closed-loop continuous algal propagator using artificial illumination. Unicellular algae are cultured in aqueous inorganic media, contacted with cabin gas, and exposed to fluorescent light in thin layers. Inputs to the process are carbon dioxide, fresh culture medium, and light energy. The products are oxygen and raw foodstuff in the form of algal harvest. The apparatus is instrumented to monitor and control the important parameters affecting algal growth. Culture density is automatically controlled by a photodiode densitometer which regulates the addition of fresh medium and the harvest of culture. System performance has been tested using three different species of algae. Author (TAB)

N70-27086# Louisville Univ., Ky. Performance Research Lab.
STUDIES OF PERFORMANCE ASSESSMENT AND ENHANCEMENT Annual Progress Report, 1 Sep. 1968 – 31 Aug. 1969
Earl A. Alluisi and Glynn D. Coates 30 Sep. 1969 39 p refs
(Contract DAHC19-69-C-0009)
(AD-701092; PR-69-13) Avail: CFSTI CSCL 5/10

An annual progress report presents brief summaries of research activities under six major headings: Studies of sustained performance; psychophysiological and biomedical correlates; personality, social, and subjective correlates; technical studies and supporting laboratory research; methodological and theoretical formulations; and liaison activities. Author (TAB)

N70-27089# School of Aerospace Medicine, Brooks AFB, Tex.
CALIBRATION AND EVALUATION OF THE USAFSAM WHOLE-BODY COUNTER Final Report, May 1968 – Feb. 1969
John Taboada Nov. 1969 18 p refs
(AD-700721; SAM-TR-69-67) Avail: CFSTI CSCL 6/12

A large volume 4 pi geometry liquid scintillator whole-body counter was installed at the USAF School of Aerospace Medicine (SAM). The counter was designed for the low-level detection and assay of the radionuclides present, naturally or otherwise, in the human body. Presented are system description, adjustment, and calibration technics employed in preparing the counter for assaying cesium-137 (137Cs) and potassium-40 (40K) in the human body. Included in this report is a brief comparison of the SAM counter with similar whole-body types. Author (TAB)

N70-27137*# Serendipity Associates, Arlington, Va.
OFF-DUTY ACTIVITY EQUIPMENT AND FACILITIES FOR ADVANCED SPACECRAFT (PRELIMINARY DESIGN)
John W. Eberhard and Frederic A. Hooper, Jr. Mar. 1970 150 p refs
(Contract NAS9-9338)
(NASA-CR-108410) Avail: CFSTI CSCL 05E

Preliminary designs for off-duty activity equipment and facilities for space stations and space bases were developed. The general objective was to identify feasible off-duty activities, equipment, and facilities to support anticipated missions in such vehicles. Off-duty activities performed by confined individuals and differences in off-duty activities due to crew size and composition were identified. Author

N70-27231*# Case Western Reserve Univ., Cleveland, Ohio. Digital Systems Lab.
A COMPUTER AIDED TELEOPERATOR SYSTEM Final Report
H. W. Mergler, Peter Hammon, Richard Taylor, Jon Beckett, and Norman Diederich Feb. 1970 194 p refs Sponsored in part by AEC
(Grant NGR-36-003-042)
(NASA-CR-109769; FR-1-70-80) Avail: CFSTI CSCL 05H

An experimental teleoperator system is presented which utilizes a general purpose digital computer to assist the operator in performing various tasks. A specific task was selected to test the system. This task involves the use of the teleoperator in the disassembly of a model of a nuclear reactor. Several pieces of equipment were constructed to permit the operator to communicate with the teleoperator system through the computer. These devices are described and their use is detailed. The computer aided teleoperator system utilizes a series of algorithms to perform the necessary control functions. These algorithms along with other special functions can be initiated by the operator from the teletype control console. This function is permitted by a teletype executive control routine which handles this selection. By means of this teletype executive routine the operator can indicate the mode of operation desired including manual, semi-automatic, and fully automatic under the control of another executive routine which is controlled by paper tape. Author

N70-27408# Uniroyal, Inc., Wayne, N.J. Research Center.
RESEARCH AND DEVELOPMENT ON A PASSIVELY PRESSURIZED FLIGHT UNIFORM Final Report, Jul. 1966 – Oct. 1968
Robert A. Fowkes and Mark W. Olson Dec. 1969 35 p
(Contract AF 33(615)-5261)
(AD-702537; AMRL-TR-69-56) Avail: CFSTI CSCL 6/17

A high altitude protection suit was developed of the partial pressure type that utilizes 40 sealed cells each containing a small air charge so they expand in accord with Boyles law when the atmospheric pressure is reduced. These independently acting, expandable, tubular cells are restrained within a stretch resistant but porous coverall in a manner to allow them to pressurize the body of the wearer. When the coverall is worn with pressure gloves, boots and a pressure helmet, it is possible to pressurize the entire body sufficiently for altitude exposure up to 100,000 feet for at least several minutes. The suit is fabricated of NOMEX material, with pleated cells of polyurethane, and an inner comfort liner. The experimental suits were evaluated through actual wear in the altitude chambers at the USAF School of Aerospace Medicine. Results of these tests confirm the potential of this approach for providing aircrew protection. Further refinement is needed to obtain a design more suitable for use in the field and to assure balanced respiratory pressures. Author (TAB)

N70-27438*# Union Carbide Corp., Tarrytown, N.Y. Linde Div.
DECOMPRESSION PROCEDURES FOR THE SAFE ASCENT OF AEROSPACE PERSONNEL FROM GROUND LEVEL TO ALTITUDE, SUPPLEMENT A Final Report
H. R. Schreiner 28 Feb. 1970 43 p
(Contract NAS9-8978)
(NASA-CR-108420) Avail: CFSTI CSCL 05E

Manned altitude flight records were subjected to a theoretical analysis to determine the parameters affecting construction of decompression tables for aerospace personnel. For flights in which nitrogen was the only inert gas breathed, the maximum tissue nitrogen tensions in the slowest hypothetical gas exchange compartment of a decompression model are developed which permit safe ascent and exposure to a given target altitude for up to 10, 60, and 120 minutes, respectively. The resulting information was used to compute the preoxygenation time at ground level required for safe ascent to several target altitudes as a function of the

duration of the intended exposure to altitude. Based on the ascent-limiting nitrogen partial pressures, decompression tables are constructed for ascent to total pressures ranging from 500 to 150 mm Hg after saturation with nitrogen at partial pressures ranging from 600 to 50 mm Hg. The information is displayed as preoxygentation time required to ascent to the target total pressure within 60 seconds. See also N70-27436. Author

N70-27436*# Union Carbide Corp., Tarrytown, N.Y. Linde Div.
DECOMPRESSION PROCEDURES FOR THE SAFE ASCENT OF AEROSPACE PERSONNEL FROM GROUND LEVEL TO ALTITUDE, SUPPLEMENT B Final Report
H. R. Schreiner 28 Feb. 1970 19 p refs
(Contract NAS9-6978)
(NASA-CR-108421) Avail: CFSTI CSCL 05E

A single repetitive diving/flying decompression table was developed to enable astronauts to determine the surface intervals required, breathing either air or oxygen, before making a safe ascent to cabin pressure altitudes. The table considers hyperbaric exposures to air at depth increments from 0 to 47 feet of sea water for durations up to 40, 80, and 120 minutes at a frequency of up to 2 exposures per day separated by surface intervals of at least 120, 180, or 240 minutes. Using the developed mathematical model of decompression and the analyzed decompression experiences obtained from manned altitude flight records, the table is expected to be capable of predicting the outcome of experimental diving/flying exposures. See also N70-24735. Author

N70-27494# Defense Documentation Center, Arlington, Va.
FREEZE DRYING, VOLUME 1 BIBLIOGRAPHY, JUN. 1954 – OCT. 1969
Feb. 1970 135 p refs
(AD-702700; DDC-TAS-70-11-Vol-1) Avail: CFSTI CSCL 6/8

The annotated references to reports in the bibliography contain information on freeze drying used in chemical and biological research, and in food preservation. Author (TAB)

N70-27563# National Physical Lab., Teddington (England). Aerodyanmics Div.
PROPOSED VALUE OF RETSPL FOR THE IEC ARTIFICIAL EAR
M. E. Delany Jul. 1969 10 p refs
(NPL-AERO-Ac-42) Copyright. Avail: CFSTI

With the acceptance by the International Electrochemical Commission of a new artificial ear designed to be used for calibrating earphones used in audiometry, there is now a basis for the International Organization for Standardization to unify the existing values of reference equivalent threshold sound pressure level (RETSPL). It is shown that a single specification of threshold is possible which would be valid for a variety of earphones currently used in audiometry. Explicit proposals are made for the numerical values of RETSPL for the I.E.C. artificial ear. Author (ESRO)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N70-26547 National Lending Library for Science and Technology, Boston Spa (England).
THE SEPARATION OF REACTION WATER FROM FUEL CELLS BY DIFFUSION ANC CONDENSATION
H. Gutbier 28 Nov. 1969 23 p refs Transl. into ENGLISH from Chem. Ing.-Tech. (German), v. 40, no. 24, 1968 p 1209 - 1214
(NLL-M-7880-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

An evaporation method was developed for separating the reaction water from fuel cells, in which the opposing evaporation and condensation surfaces are separated only by a narrow gas-filled slit. The liquid surface is stabilized mechanically by a porous membrane. The rate of water separation is measured as a function of temperature and electrolyte concentration. The test results are discussed in conjunction with theoretical considerations. The technical application of the method is described for hydrogen oxygen fuel cells. Author

N70-26563# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
PREPARATION OF HIGHLY PURE NEPTUNIUM OXIDE
William V. Conner and Stephen G. Procter 23 Dec. 1969 5 p refs
(Contract AT(29-1)-1106)
(RFP-1416) Avail: CFSTI

A 200-gram batch of neptunium was purified using a combined nitrate and chloride anion exchange process. The actinide impurity content of the purified NpO2 product was less than 0.1 ppM of plutonium and americium, less than 0.2 ppM thorium, and 7ppM uranium. The total for all impurities was 407 ppM. Author (NSA)

N70-26564# Tennessee Univ., Knoxville. Dept. of Chemistry.
ELECTROCHEMICAL STUDIES IN MOLTEN FLUORIDES AND OTHER HALIDES Progress Report, 1 Apr. 1969 - 31 Mar. 1970
Gleb Mamantov 31 Mar. 1970 9 p refs
(Contract AT(40-1)-3518)
(ORO-3518-13) Avail: CFSTI

Voltammetric studies on the lower oxidation states of thorium in the LiF-ThF4 (73-27 mole %) melt in contact with metallic thorium have to date been unsuccessful because of the formation of a metallic surface film (possibly thorium) and the lack of wetting of the boron nitride sheath of the Ni/NiF2 reference electrode. Studies on the use of solid LaF3 to provide ionic contact between the reference and the working compartments were initiated. Spectral evidence for the superoxide ion in LiF-NaF-KF (46.5-11.5-42.0 mole %) melts to which oxidizing agents MnF3 or CoF3 were added, points out the need for further purification of fluoride melts. Electroreduction of Bi(III), Hg(II), Hg(I), and Ni(II) in molten NaCl-AlCl3 (37-63 mole % and other compositions) was investigated. Evidence for the electrochemical formation of Bi(I) was obtained. Raman spectra of AlCl3-NaCl melts for compositions ranging from 50-50 mole % to pure AlCl3 were obtained. Author (NSA)

N70-26571 Pennsylvania Univ., Philadelphia.
THE USE OF LIAPUNOV FUNCTIONALS IN STABILITY STUDIES OF DISTRIBUTED PARAMETER SYSTEMS
Alan Michael Kugelman (Ph.D. Thesis) 1969 313 p
Avail: Univ. Microfilms: HC $14.20/Microfilm $4.05 Order No. 69-21386

Regions of asymptotic stability are established about the steady state profiles of two distributed reactor systems: a tubular reactor with axial mixing and a non-isothermal, porous catalyst particle. Although regions of asymptotic stability have been reported for many lumped parameter systems (system described by ordinary differential equations), they have not as yet been reported for any distrubuted parameter systems (system described by partial differential equations). For the tubular reactor, temperature and concentration are distributed along the length of the reactor; diffusion and convection of heat and mass along the reactor length are included but the analogous effects in the radial direction are assumed negligible. For the catalyst particle, temperature and concentration are distributed along the length of the particle; effective diffusion is assumed to be the prevalent mode of heat and mass transfer in the pores of the particle. An exothermic, first order, irreversible reaction is assumed to occur in both systems. Dissert. Abstr.

N70-26576 Clarkson Coll. of Technology, Potsdam, N.Y.
THE THERMOLUMINESCENCE SPECTRUM AND THE ENERGY CONVERSION EFFICIENCY OF LITHIUM FLUORIDE
Alfred Michael Strash (Ph.D. Thesis) 1969 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-21159)

Thermoluminescence spectra were measured for lithium-fluoride powder irradiated by protons and also by gamma rays. Two different phosphors were used, Harshaw TLD-100 and Harshaw TLD-600. Thermoluminescence spectra are given for samples irradiated with 85 MeV protons and with cobalt-60 gamma rays. The spectra appear to exhibit structure in the wavelength region around 5500 A. The proton irradiations include doses of 110, 564, 1120 and 11,200 rads in TLD-600 and an irradiation of 588 rads in TLD-100. Also, TLD-100 and TLD-600 were irradiated to 500 rads by gamma rays. The thermoluminescence energy emitted from a sample was obtained by integration over a calibrated spectrum. The calibration was checked with an electroluminescent panel of known spectral emission. Typical values of the total efficiency of the phosphors range from 0.10% to 0.15%. A relation to express the efficiency in the supralinear region was determined. Dissert. Abstr.

N70-26800 Alfred Univ., N.Y.
THE VIBRATIONAL SPECTROSCOPY AND NORMAL COORDINATE ANALYSIS OF GEOLOGICAL APATITES
Stephen Robert Levitt (Ph.D. Thesis) 1969 249 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.25 Order No. 69-19781

The infrared and laser-Raman spectra are obtained for the geological apatites: fluorapatite Ca10(PO4)6F2, chlorapatite Ca10(PO4)6Cl2,hydroxyapatite Ca10(PO4)6(OH)2,pyromorphite Pb10(PO4)6Cl2, mimetite Pb10(AsO4)6Cl2, and vanadinite Pb10(VO4)6Cl2. Factor-group analyses based on unit-cell symmetry considerations account for the spectral behavior observed and lend insight into intermolecular vibrational coupling within the unit cell. Other crystal-field effects on the spectra of calcium and lead apatites are discussed and correlated with the results of X ray and normal coordinate analyses. Normal coordinate analyses based on a simple Urey - Bradley force field are performed to obtain reasonable sets of molecular force constants, to make vibrational band assignments, and to test the applicability of the Urey - Bradley force field to the XO4(3 -) groups in apatite solids. These results are used to obtain both structural and chemical information by comparing derived force constants among the different solids and making correlations with molecular parameters. Dissert. Abstr.

N70-26641# Chicago Univ., Ill.
VISCOSITIES OF SOLUTIONS OF POTASSIUM IN LIQUID AMMONIA AND DEUTERO-AMMONIA
Clyde A. Hutchison, Jr. and Donald E. O'Reilly 12 Nov. 1969 19 p refs
(COO-294-11) Avail: CFSTI

The viscosities of solutions of potassium in liquid ammonia and deutero-ammonia were measured with an Ostwald viscosimeter at 33.6 C, 0.0 C, and +20.0 C, over a concentration range from zero to approximately 1.5 mole/liter. The methods of measurement and the experimental results are given. The viscosities, eta, of the pure liquids, measured in centipoise, are least squares fitted by the relations, log sub e eta = -4.677 + 1.577/RT for ammonia and log sub e eta = -4.676 + 1.670/RT for deutero-ammonia, in which R is the gas constant and T is the Kelvin temperature. Author (NSA)

N70-26670# Chalmers Univ. of Technology, Goteborg (Sweden).
ON THE CHEMISTRY OF SOLIDS, SOME PRESENT AND FUTURE APPLICATIONS
J. Arvid Hedvall 1969 23 p refs
(PB-187244; Rept-326) Avail: CFSTI CSCL 07D

It is the author's intention to make a brief survey of the chemistry of solids, as experienced through his own and collaborators' researches. Discussed are preliminary powder reactions at low temperatures, influence of hereditary structures, exchange reactions, a type unknown before, the effect of structural transformation and thermal decomposition, effects of deviations from normal chemical formulae, work in catalysis, the effect of irradiation, corrosion experiments, influence of changes in the magnetic or electrical state, influence of chemically inert gases dissolved in solids, investigations into geological and mineralogical subjects, and problems of building materials and archeology. USGRDR

N70-26722# Dow Chemical Co., Golden, Colo.
PROTON RESONANCE STUDIES IN PARAMAGNETIC ORGANOMETALLIC URANIUM(4)-ALKOXY-COMPLEXES
R. V. Ammon et al [1969] 19 p refs Transl. into ENGLISH from Radiochim Acta, v. 11, 1969 p 162 - 168
(RFP-Trans-61) Avail: CFSTI

A number of different paramagnetic tricyclopentadienyluranium-(IV)-alkoxy-complexes were synthesized in rather high yields by a new method, and characterized by various physical properties. Particular attention was paid to the investigation and discussion of the PMR-spectra. It appears possible to estimate the amount of the pseudocontact- and Fermi-contact-contributions to the overall isotropic shift of ring- and alkyl-protons, respectively. The PMR-spectra thus provide excellent supplementary information in addition to previous results obtained from other physical methods about this class of compounds. Author (NSA)

N70-26779# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE MERCURY PHOTOSENSITIZED OXIDATION OF PERFLUOROBUTENE-2, JANUARY 1967 - JANUARY 1968
T. H. Johnston and J. Heicklen 15 Nov. 1969 24 p refs
(Contract F04701-69-C-0066)
(AD-701741; TR-0066-(5250-40)-6; SAMSO-TR-70-52) Avail: CFSTI CSCL 7/5

The mercury-photosensitized oxidation of C4F8-2 at room temperature yields CF3CFO as the sole initial product. The CF3CFO is formed by the reaction of electronically excited C4F8-2 with O2. The electronically excited molecule can also internally convert to the ground state. A detailed reaction scheme and relative rate constants are given. Author (TAB)

N70-26781# Texas Technological Coll., Lubbock. Dept. of Chemistry.
INFRARED STUDIES USING THE MATRIX ISOLATION TECHNIQUE Final Report, 15 Jun. 1967 - 30 Sep. 1969
Richard L. Redington 30 Sep. 1969 92 p refs
(Contract DAHC04-67-C-0069)
(AD-701120; AROD-7513-8-C) Avail: CFSTI CSCL 7/4

Briefly summarized are the results of research using matrix isolation techniques to study the infrared spectra of reactive halogen compounds such as SbF5, AsF5, ClF3, BrF3, BrF5, LiF, CH3COOH, and CCl3COOH. The main text of the report consists of four articles with the following titles: Infrared matrix-isolation spectra and the mechanism for F atom exchange in ClF3, BrF3, and SF4; On the calculation of unique force constants (F2O, O3, Cl2O, H2S, H2O, NF3, H2CO); Properties of LiF molecules; and Infrared spectra of matrix isolated acetic acid monomers. TAB

N70-26823# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RECTIFICATION-SUBLIMATION OF PYROMELLITIC DIANHYDRIDE
M. F. Mazitov et al 8 Oct. 1969 8 p refs Transl. into ENGLISH from Khim. Prom. (Leningrad), v. 45, no. 45, 1969 p 18 - 19
(AD-700606; FTD-MT-24-239-69) Avail: CFSTI CSCL 7/1

Pyromellitic dianhydride (PMDA) 1,2,4,5-benzetetracarboxylic 1,2:4,5-dianhydride, used in the synthesis of polyimides, is usually purified by recrystallization or fractional distillation-sublimation, using mineral oil as a third component. The authors ascertained the feasibility of purifying PMDA by rectification-sublimation, excluding the third component. Vacuum rectification with subsequent sublimation of the PMDA was used. Installation consisted of a vat, still, and U-shaped dephlegmator connected to a condensor and receptacle. Temperature and pressure were selected, using the dependence of the vapor pressure of PMDA on temperature. Without the third component, the distilled PMDA from the durol crude source product by the given method, was 99.2-99.6% pure, but the yield was only 45-50% of the potential. Author (TAB)

N70-26837# Georgia Univ., Athens. Dept. of Chemistry.
COORDINATION COMPOUNDS OF THE TRANSITION METALS AS RELATED TO THE CATALYTIC PROCESS AND TO THE SYNTHESIS OF NEW MATERIALS Semiannual Progress Report
R. B. King, Pramesh N. Kapoor, A. Efraty, M. S. Saran et al Jan. 1970 21 p refs
(Contract AF-AFOSR-1435-68)
(AD-701098; AFOSR-70-0351TR) Avail: CFSTI CSCL 7/3

Numerous new metal halide, carbonyl, and cyclopentadienyl complexes of the chelating tritertiary phosphine bis(2-diphenylphosphinoethyl) phenylphosphine and the chelating tetratertiary phosphines 1,1,4,7,10, 10-hexaphenyl-1,4,7,10-tetraphosphadecane and tris(2-diphenylphosphinoethyl) phosphine are described. Some preliminary studies of reactions of metal carbonyl derivatives with diphenylvinylphosphine are discussed. Metal complexes of the acetylenic tertiary phosphines (C6H5)2PCH2CCCH2P(C6H5)2 and (C6H5)2PCCC6H5 are described. A few reactions of tris(dimethylamino)arsine with various metal carbonyls are summarized; these resulted in the preparation of the first derivative with two tris(dimethylamino)arsine ligands attached to a single metal atom. The mixed phosphine-isonitrile and arsine-isontrile ligands (C6H5)2ECH2CH2NC(E = P or As) have been prepared by the base-catalyzed addition of (C6H5)2EH(E = P or As) to vinyl isocyanide; these are the first known compounds containing both tertiary phosphine (or arsine) and isonitrile groups. Some new compounds have been obtained from pentacarbonyliron and the diacetylenes 1,7-cyclotridecadiyne, 1,8-cyclotetradecadiyne, and 2,4-hexadiyne. Possible aerospace applications of this research are discussed. Author (TAB)

N70-26840# California Univ., Santa Barbara. Dept. of Chemistry.
DEUTERIUM AND SOLVENT EFFECTS ON BENZALDEHYDE PHOSPHORESCENCE Technical Report
Jerry Simpson and Henry Offen 3 Feb. 1970 12 p refs
(Contract N00014-69-A-0200-8002)
(AD-700659; TR-20) Avail: CFSTI CSCL 7/4

The phosphorescence lifetime and spectra of benzaldehyde, benzaldehyde-d1 and benzaldehyde-d6 have been measured in methylcyclohexane, EPA, and 85% H3PO4 glasses at 77K. The measurements are consistent with a triplet state assignement of triplet n, pi* in methylcyclohexane, triplet pi, pi* in H3PO4 and of intermediate character in EPA. Replacement of the aldehydic proton by deuterium significantly lengthens the phosphorescence lifetimes in EPA and H3PO4. Author (TAB)

N70-26848# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INHIBITING ACTION OF ETHYLAMINES AND PROPYLAMINES ON THE RATE OF COMBUSTION OF A MIXTURE OF 2 H2 AND O2
K. T. Oganesyan et al 15 Oct. 1969 12 p refs Transl. into ENGLISH from Armyansk. Khim. Zh. (USSR), v. 21, no. 9, 1968 p 737-742
(AD-700588; FTD-HT-23-304-69) Avail: CFSTI CSCL 21/2

A study was made of the effect of small additions of ethyl- and propylamines on the lower limit of autoignition of a stoichiomatric mixture of hydrogen with oxygen. It was shown that these additions retard the combustion process. An increase in their concentration leads to an intensification of the inhibiting effect and to an increase in the limit of ignition of a mixture of 2 H2 + O2. The EPR method in the rarefied flame of a mixture of 2 H2 + O2 amine was used to obtain the dependence of concentration of active particles on the amine content. An inverse relationship between the amount of amine in the combustible mixture and the intensity of EPR signals of H and O atoms and OH radicals was established. The following effective rate constants of the reaction were found. Author (TAB)

N70-26863# Sheffield Univ. (England). Dept. of Chemistry.
QUANTUM THEORY OF ATOMS AND MOLECULES Final Technical Report, Mar. 1968 - Feb. 1969
R. Mc Weeny and D. B. Cook Mar. 1969 37 p refs
(Contract DAJA37-68-C-0775)
(AD-701127) Avail: CFSTI CSCL 7/4

Wavefunction calculations on polyatomic molecules are fully reported. In this work a variety of approximation schemes have been exhaustively tested and compared, using a series of molecules including CH4, NH3, HCN, H2S, B2H6. The scheme finally adopted is capable of successfully predicting not only energies but also equilibrium configurations: d-orbitals have been included to admit applications to transition metal complexes and preliminary applications in this area are in progress. The multi-configuration self-consistent field (MC SCF) method was formulated and successfully implemented in high-precision calculations on LiH. The method of obtaining a solution of the MC SCF equations, in their most general form, is convergent and will be applied (with improved computing facilities) to larger polyatomic molecules. The computer program systems used in most of the calculations on polyatomic molecules was brought to a final form, suitable for use with computers of modest size, and are fully described. Author (TAB)

N70-26865# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
MATERIALS RESEARCH . Technical Report, 1 Jul. 1967-30 Jun. 1969
Michael Hoch Nov. 1969 40 p refs
(Contract F33615-67-C-1565)
(AD-700860; AFML-TR-69-305) Avail: CFSTI CSCL 11/7

The report summarizes analytical research performed during the designated period September 1, 1967 through May 31, 1969, on experimental materials, both organic and inorganic, with particular emphasis on such techniques as mass spectrometry, both organic and inorganic, x-rays, and organic and inorganic analysis. Author (TAB)

N70-26888# Battelle Memorial Inst., Columbus, Ohio.
A KINETIC STUDY OF THE THERMAL DECOMPOSITION OF SELECTED CYCLOHEXYL AND PHENYLSILANES Final Report, 1 May 1964-30 Jun. 1969
Robert W. Coutant and Arthur Levy Dec. 1969 36 p refs
(Contract AF 33(615)-1807)
(AD-701730; ARL-69-0213) Avail: CFSTI CSCL 7/4

The thermal-decompositon kinetics of the following arylsilanes have been investigated using both static and flow techniques: monophenylsilane, diphenylsilane, triphenylsilane, tetraphenylsilane, diphenyldimethylsilane, and triphenylmethylsilane. The phenylhydrosilanes decompose via a bimolecular second-order redistribution reaction, with no evidence for free-radical formation. On the other hand, the main mode of decomposition of tetraphenylsilane involves elimination of phenyl radicals followed by attack of these radicals on the parent silane. The decomposition of the phenylmethylsilanes also proceeds via free-radical mechanism, but the main reaction path results in intramolecular cyclization.

yielding compounds containing the dibenzosilole nucleus. Reasons for these three basically different modes of reaction are discussed in terms of substituent size and degree of (p-d)pi bonding between the phenyl rings and silicon. Author (TAB)

N70-26915# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE SYNTHESIS OF HIGH-MOLECULAR FLUORINATED POLYHETEROCYCLES
E. L. Zaitseva et al 15 Aug. 1969 8 p refs Transl. into ENGLISH from Vysokomol. Soedin. Ser. B (Moscow), v. 9, no. 7, 1967 p 498–499
(AD-700396; FTD-HT-23-326-68) Avail: CFSTI CSCL 7/3

The polyheterocycles with perfluoromethylene bridges in the basic chain which are described in the literature are either cross-linked (structured polyperfluoromethylene triazines) or low-molecular linear polymers (polyperfluoromethylene benzoxazoles, polyperfluoromethylene benzimidazoles, etc.) For the first time high-molecular linear polyheterocycles were obtained with perfluoromethylene bridges: (Poly(bibenzoxazolediyl-phenylene-hexafluorotrimethylene-phenylene) and poly(bibenzimidazolediyl-phenylene-hexafluorotrimethylene-phenylene). These were synthesized from derivatives of alpha, omega-(di-(4-carboxyphenyl)) perfluoropentane. Author (TAB)

N70-26919# ARO, Inc., Arnold Air Force Station, Tenn.
SORPTION PUMPING OF HYDROGEN BY CRYODEPOSITS: SORPTION CAPACITY MEASUREMENT
K. E. Templemeyer (Ph.D. Thesis—Tennessee Univ.) Feb. 1970 84 p refs
(Contract F40600-69-C-0001)
(AD-700980; AEDC-TR-69-266) Avail: CFSTI CSCL 7/4

The state-of-the-art of cryosorption of hydrogen (H2) and helium by cold cryodeposited frost is reviewed and summarized in some detail, and the results of additional measurements of the sorption of H2 by carbon dioxide (CO2) frosts are reported. It is shown that the sorption capacity of the frost depends upon the conditions at which the frost was formed and upon its temperature history. Frosts formed in a manner to make them porous or disordered are shown to possess greater sorption capacities. It appears that surface diffusion of adsorbed molecules into a disordered frost structure is the basic pumping mechanism. Isotherms for H2 sorbed by CO2 frosts formed over a wide range of conditions are presented. Also, the reuse sorption capacity of CO2 frost is well documented. As a result of the present tests, it is now possible to put the process of frost cryosorption pumping into better perspective and understand the conflicting results of previous experimental investigations. Author (TAB)

N70-26923# Instituto de Energia Atomica, Sao Paulo (Brazil).
STUDY OF THE INFLUENCE OF VARIOUS FACTORS ON THE RADIOCHEMICAL: GUTZEIT METHOD OF ACTIVATION ANALYSIS OF ARSENIC
Fausto W. Lima and Celia M. Silva Nov. 1968 20 p refs Presented at the 2nd Inter-Am. Conf. on Radiochemistry, Mexico City, 22–25 Apr. 1968
(IEA-176; CONF-680423-3) Avail: AEC Depository Libraries

Various factors that might influence recovery of arsenic in the radio-chemical-Gutzeit method of determination of arsenic were studied. The factors examined were method of digestion of samples, time of reaction, amount of iron ions, amount of stannous ions, interference caused by the presence of antimony and copper, effect of agitation of reaction flasks on abbreviating the time of reaction and amount of arsenic carrier required for a high recovery of arsenic. Precision and accuracy of the proposed method were determined. Author (NSA)

N70-26932# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
D2O SUPPLY BY THE HYDROGEN-AMMONIA TWO-TEMPERATURE PROCESS
E. W. Becker et al Oct. 1969 14 p refs Transl. into ENGLISH from Atomwirtschaft (Duesseldorf), v. 14, 1969 p 257–260
(LIB-TRANS-224) Avail: AEC Depository Libraries

Studies were made of the optimal construction and product costs of a H2/NH3 dual-temperature arrangement. Technological calculations for a 100-ton installation are presented. NSA

N70-26938# Kansas Univ., Lawrence.
[HIGH TEMPERATURE CHEMISTRY] Progress Report, 1 Nov. 1968–31 Oct. 1969
31 Oct. 1969 25 p refs
(Contract AT(11-1)-1140)
(COO-1140-182) Avail: CFSTI

Studies are in progress which are designed to resolve discrepancies in thermodynamic values for the vaporization of titanium oxides. Vaporization of gadolinium sulfide, dysprosium monosulfide, and yttrium monosulfide was studied. Isomolecular reactions were performed on eight binary rare earth sulfide systems. Progress in research on the kinetics of high temperature vaporization reactions is reported. NSA

N70-26940# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
NUCLEAR MAGNETIC RESONANCE SPECTRAL STUDIES OF AMIDES Technical Report, Mar. 1967–Nov. 1969
Daniel S. Dyer and Ronald G. Lewis Dec. 1969 71 p refs
(AD-701724; AFML-TR-69-325) Avail: CFSTI CSCL 7/4

The temperature and solvent dependence of the nuclear magnetic resonance (nmr) spectra of a number of amides has been studied. Hindered internal rotation about the C(O)-N and aryl-nitrogen bonds was detected in a series of N-acylhydrazobenzenes. In this series of compounds, hindered rotation about the C(O)-N bond afforded, in most cases, a mixture of cis-trans isomers in solution. These isomers were easily detected by nmr spectroscopy. Thus the free energies of activation, at the coalescence temperatures, for the hindered rotations were calculated. Similar temperature dependence studies on the nmr spectra of N-phenylacetamide and N-(o-tolyl) acetamide also afforded evidance for hindered internal rotation about the C(O)-N bond. However for these compounds, one isomer predominated to such a degree in solution that the presence of the second isomer was barely detected by nmr spectroscopy. A temperature dependence study of the fluorine-19 resonance spectra of both 1 and 2 deg rotation about the C(O)-N bond. However for the first time, coupling between the trifluoromethyl group and a nitrogen proton was observed. Also the proton nmr spectrum of 1,1,1-trifluoroacetamide, itself, in a dry acetone solution at low temperatures afforded the direct observation of two separate signals for the two nitrogen protons. Author (TAB)

N70-26952# Army Foreign Science and Technology Center, Washington, D.C.
INVESTIGATION OF THE RADIOCHEMICAL SENSITIZATION EFFECT IN RUBBER [ISSLEDOVANIE EFFEKTA SENSIBILIZATSII RADIATSIONNO KALMICHESKIKH PROTSESSOV V KAUEHUKAKH]
V. T. Kozlov et al 20 Nov. 1969 20 p refs Transl. into ENGLISH from Vysokomolekul. Soedin. (USSR), v. 10, no. 5, 1968 p 987–994
(AD-701946; FSTC-HT-23-139-70) Avail: CFSTI CSCL 7/5

Certain characteristic effects of a number of halogen containing compounds, used earlier as radio-chemical structuring sensitizers for rubbers of different structure were investigated. As a result of the investigation, the following conclusions were drawn: (1) during radiolysis the sensitization effect in a number of halogen containing

organic substances increases from complex aromatic structures with a large number of atoms to linear structures without double bonds and with a small number of atoms; (2) in the general case of the sensitization effect is displayed by compounds containing atoms with high electronaffinity and possessing the ability to accept thermalized electrons; (3) during the radiolysis of appropriate sensitizers one of the most important processes is the splitting of halogen, where a significant contribution is made by the dissociative electron capture reaction; and (4) it was hypothesized that the electron capture processes increase the probability of ion-molecular reactions of the primary ions with the formation of cross linking. Author (TAB)

N70-26975# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
ULTRAVIOLET SPECTROPHOTOMETRIC DETERMINATION OF ISOTRUXENE IN AUTOCLAVE-PRODUCED INDENE POLYMERS
N. J. Williams 13 Jan. 1970 14 p refs
(Contract W-7405-eng-26)
(Y-1704) Avail: CFSTI

A spectrophotometric method was developed for determining the content of isotruxene in truxene - isotruxene mixtures produced by the autoclave polymerization of indene. The accuracy of the method is not precisely known due to the uncertainty of the impurity level in the isotruxene standard; however, it is estimated to be + or - 3.4 percent absolute assuming the purity of the isotruxene is 97 + or - 2 percent absolute. Author (NSA)

N70-26976# Technische Hochschule Hannover (West Germany). Inst. fuer Technische Chemie.
MEASUREMENT OF THE SOLUTE CONCENTRATIONS AT THE INTERFACE OF TWO LIQUIDS BY THE LIQUID SCINTILLATION TECHNIQUE [BERUEHRUNGSLOSE MESSUNG VON KONZENTRATIONEN AN FLUESSIG-FLUESSIG-PHASENGRENZEN]
H. G. Blaschke Bundesministerium fuer Wiss. Forsch. Oct. 1969 47 p refs In GERMAN; ENGLISH summary
(BMwF-FBK-69-34) Avail: AEC Depository Libraries

At the interface of two-phase systems consisting of a water solution of a weak beta emitter and an organic solvent solution of scintillators luminescent scintillation occurs. The scintillation rate depends on the range of beta rays, the specific activity of the water phase, and the surface area of the interface. This surface scintillation can be quenched by suitable substances. The quenching occurs only at the interface on the solvent side and it can be used to estimate the concentration of the quencher at the interface. By application of beta emitters with different mean ranges (H-3, C-14) it is possible to esimate some points of the concentration gradient of the solute at the interface. Author (NSA)

N70-26983*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
KINETIC STUDY OF FLUORINATION OF SILVER
Patricia M. O'Donnell Washington May 1970 20 p refs
(NASA-TN-D-5799; E-5140) Avail: CFSTI CSCL 07D

The kinetics of the reaction of fluorine with silver were studied at temperatures from 25 deg to 300 C (298 to 573 K) and 50- to 600-torr fluorine pressure. The reaction is pressure dependent and is described by a given equation. Three products are identified: silver subfluoride, silver monofluoride, and silver difluoride. The calculated value of the diffusion constant is 0.10 square cm/sec, and the activation energy for the diffusion process is 10 kcal/mole. Silver ion vacancy migration is proposed as the diffusion mechanism. Reaction-rate constants are listed. Author

N70-27011# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Fluid Mechanics Section.
DECOMPOSITION MECHANISM FOR CN MOLECULES
M. W. Slack and E. S. Fishburne Apr. 1970 19 p refs Submitted for publication
(RM-473J) Avail: CFSTI

Two different reaction mechanisms, CN + CN → C2 + N2 and CN + M → C + N + M, were reported for the decomposition of CN molecules behind shock waves. The current analytical study demonstrates that these two observed mechanisms are special cases of the generally applicable CN decomposition chain CN + M → C + N + M, C + CN → C2 + N, and N + CN → N2 + C in which the first reaction or a combination of the second and third reactions can dominate, depending on temperature and CN concentration. Author

N70-27054*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTROCHEMICAL BEHAVIOR OF THE BORON ANODE IN AQUEOUS SOLUTIONS
Betty S. Del Duca [1970] 24 p refs Presented at the Chem. Vapor Deposition Conf., Los Angeles, 10-15 May 1970
(NASA-TM-X-52806; E-5684) Avail: CFSTI CSCL 07D

The electrochemical oxidation of p-type boron in 0.2 N $NaNO_3$ solutions of pH 0.4-13.1 was studied by galvanostatic techniques. The capacitance of the electrode, Tafel slopes and a limited analysis of reaction mechanism is reported. The anodic dissolution in acid solution is a charge transfer limited one electron reaction to form a monovalent species in the overpotential region of .25 to .70 volts. The dissolution in basic solution is most probably a one electron charge transfer reaction from a monovalent to divalent species involving three hydroxyl ions. Open circuit potentials were mixed potentials, probably due to hydrogen formation at open circuit but not contributing to the electrochemical reaction at the applied overpotential. The level of illumination had no effect on the electrochemical behavior of the electrode. Author

N70-27060 National Lending Library for Science and Technology, Boston Spa (England).
FLUIDIZED DRYING, PART 2 [SUSZENIE FLUIDYZACYJNE, CZ. 2]
J. Ciborowski Feb. 1970 19 p refs Transl. into ENGLISH from Przem. Chem. (Poland), v. 42, no. 3, 1963 p 128 - 132
(NLL-RTS-5639) Avail: Natl. Lending Library, Boston Spa, Engl.: 12s 6d or 2 NLL photocopy coupons

Special processes, problems, and technical aspects of fluidized drying of granular solids are discussed. Methods of drying small granules, large granules, mixtures of two kinds of granules, agglomerations of fine granules, and Glauber salts are described. Shock and fountain charge fluidization, and drying under high humidity and electrostatic conditions are outlined. Minerals, limestone, chalk, seed grains and seed oil products, crystals, colloidal particles, fine grained polystyrene, casein, gypsum, and sawdust are among the types of solids dried, and the method for drying gases is also given. The automatic regulation of fluidization, and production costs are considered. N.E.N.

N70-27061 National Lending Library for Science and Technology, Boston Spa (England).
FLUIDIZED DRYING, PART 1 [SUSZENIE FLUIDYZACYJNE, CZ. 1]
J. Ciborowski Feb. 1970 19 p refs Transl. into ENGLISH from Przem. Chem. (Warsaw), v. 42, no. 2, 1963 p 83 - 87
(NLL-RTS-5638) Avail: Natl. Lending Library, Boston Spa, Engl.: 12s 6d or 2 NLL photocopy coupons

Fluidized drying methods for drying powdered solids are reviewed. Various types of equipment and problems associated with them are described. The kinetics of heat and mass transfer are discussed, and a method of calculating fluidized drying is presented. N.E.N.

N70-27069 National Lending Library for Science and Technology, Boston Spa (England).
CHLOROMETHYLATION OF POLYSTYRENE WITH MONOCHLORODIMETHYL ETHER IN DIFFERENT SOLVENTS IN THE PRESENCE OF ZINC CHLORIDE AS CATALYST [KHLORMETILIROVANIE POLISTIROLA MONOKHLORDIMETILOVYM EFIROM V RAZLICHNUKH RASTVORITELYAKH V PRISUSTVII KHLORISTOGO TSINKA V KACHESTVE KATALIZATORA]
G. Z. Esipov et al [1970] 8 p refs Transl. into ENGLISH from Vysokomol. Soedin. Ser. B. (Moscow), v. 11, no. 3, 1969 p 177 179
(NLL-RTS-5551) Avail: Natl. Lending Library, Boston Spa, Engl.: 7s 6p or 1 NLL photocopy coupons

A study was made of the kinetics of the chloromethylation of polystyrene with monochlorodimethyl ether (MCDE) in dichloroethane, dioxane, chloroform, and methylene chloride in the presence of zinc chloride. It was established, that, under conditions of large dilution of the solvent, the effective concentration of the active complex which is formed by the MCDE and the zinc chloride is constant and can be expressed by the initial concentration of catalyst. It is shown that with a zinc chloride concentration in the reaction mixture of the order of .00001 mole/l, the diffusion of the active complex to the polymer molecule influences the rate of reaction. Author

N70-27070 National Lending Library for Science and Technology, Boston Spa (England).
GRANULAR ADSORPTIVE ANODES IN PROPYLENE CHLORINATION. 3: STUDIES ON THE INFLUENCE OF THE TYPE AND STRUCTURE OF THE ANODE MATERIAL
M. Stojanowa-Antonyszczyn et al Feb. 1970 14 p refs Transl. into ENGLISH from Przem. Chem. (Warsaw), v. 47, no. 6, 1968 p 360 363
(NLL-RTS-5643) Avail: Natl. Lending Library, Boston Spa, Engl.: 10s or 1 NLL photocopy coupons

Comparative experiments of propylene electrochlorination on solid carbon anodes from disintegrated graphite and on granular adsorptive electrodes were carried out. The effect of the size of microsurfaces and macrosurfaces of the granular adsorptive anode on the course of chlorination was also studied. The yields of chlorohydrines and dichloropropane increase with the increase of macrosurfaces as well as microsurfaces of the adsorptive anode. Author

N70-27071 National Lending Library for Science and Technology, Boston Spa (England).
ELECTROCHEMICAL SYNTHESIS OF HYDROXYLAMINE SULPHATE. ESTIMATING OF THE POSSIBILITY OF USING ANODES OF LEAD DIOXIDE [ELEKTROCHEMICZNA SYNTEZA SIARCZANU HYDROKSYLOAMINY. OCENA MOZLIWOSCI STOSOWANIA ANOD Z DWUTLENKU OLOWIU]
A. Korczynski et al Feb. 1970 14 p refs Transl. into ENGLISH from Przem. Chem. v. 48, no. 5, 1969 p 274 276
(NLL-RTS-5603) Avail: Natl. Lending Library, Boston Spa, Engl.: 7s 6d or 1 NLL photocopy coupons

A study was made of the effects of the conditions prevailing during the electrochemical formation of lead dioxide coatings on graphite on their resistance and on their behavior during electrolysis in a medium of sulfuric acid and sulfuric acid plus nitric acid. It was found that lead dioxide electrodes could be used as anodes in the process for obtaining hydroxylamine sulfate by electrochemical means. Author

N70-27072 National Lending Library for Science and Technology, Boston Spa (England).
ELECTROCHEMICAL METHOD FOR THE PREPARATION OF HYDROXYLAMINE SULPHATE. THE PREPARATION OF HYDROXYLAMINE SULPHATE IN THE FORM OF A SOLUTION [ELEKTROCHEMICZNA METODA OTRZYMYWANIE SIARCZANU HYDROKSYLOAMINY. OTRZYMYWANIE SIARCZANU HYDROKSYLOAMINY W POSTACI ROZTWORU]
Feb. 1970 21 p refs Transl. into ENGLISH from Przem. Chem. (Warsaw), v. 48, no. 2, 1969 p 94 98
(NLL-RTS-5605) Avail: Natl. Lending Library, Boston Spa, Engl.: 12s 6d or 2 NLL photocopy coupons

The optimum conditions for the electrochemical synthesis of hyroxylamine sulfate on an industrial scale were investigated. A concentration of 30% sulfuric acid is recommended for the catholyte. The temperature of the cathode has more influence on yield than the temperature of the catholyte, and a cathode with heat exchange from within the electrode is most suitable. It was also determined that a continuous process is superior to a batch method. N.E.N.

N70-27073 National Lending Library for Science and Technology, Boston Spa (England).
USE OF ACTIVATED CARBON WITH A CATALYST DEPOSIT IN A BIPOLAR POWDER ELECTRODE [ZASTOSOWANIE WEGLA AKTYWOWANEGO Z NANIESIONYM KATALIZATOREM W DWUBIEGUNOWO PRACUJACEJ ELEKTRODZIE PROSZKOWEJ]
W. Tomassi et al Feb. 1970 13 p refs Transl. into ENGLISH from Przem. Chem. v. 47, no. 8, 1968 p 495 497
(NLL-RTS-5537) Avail: Natl. Lending Library, Boston Spa, Engl.: 7s 6d or 1 NLL photocopy copons

The effect on the electrode function of a catalyst deposited on the carbon in bipolar electrode was studied. Platinum, which is a catalyst of both oxygen and hydrogen electrode processes, and silver, which is a catalyst of the oxygen process, were chosen as additives. Advantageous results were obtained in coupled electrolysis of copper sulfate solution and hyrochloric acid with two carbon layers in the bipolar powder electrode. One layer had silver and parafin added in the part working anodically, and the second had platinum and paraffin added in the part working cathodically. Electrolysis voltage was lowered, flow of chlorides was completely inhibited, and flow of sulfate ions was diminished. Author

N70-27077*# Midwest Research Inst., Kansas City, Mo.
SPACE THERMAL CONTROL BY USE OF SOLID/SOLID-PHASE CHANGE MATERIALS Annual Summary Report, 25 Jun. 1968 24 Jul. 1969
E. Murrill and L. W. Breed 24 Jul. 1969 134 p refs
(Contract NAS8-21452; MRI Proj. 3224-C)
(NASA-CR-102641; ASR-1) Avail: CFSTI CSCL 07C

Mechanisms of solid/solid-phase transitions and available data in the literature suggest that transitions in substances that exhibit a plastic crystalline phase may have sufficiently large enthalpies for use in passive thermal control. In a broad qualitative screening of readily available candidate materials by differential thermal analysis, 33 substances with plastic crystalline phases that had not been previously identified were found. Quantitative differential thermal calorimetry shows that five of the substances have enthalpies of transition greater than 45 cal/g. Correlations of the qualitative and quantitative data suggest structural criteria which may provide additional substances within the target range of greater than 58 cal/g at 270 deg to 370 K. Crystallization studies indicate that the solid/solid-phase transition can occur without excessive supercooling. Author

N70-27082# University of Southern Calif., Los Angeles. Dept. of Chemistry.
PROJECT ELECTROCHEMISTRY OF SOLIDS Final Report, 1 Oct. 1965 –30 Sep. 1969
Ferdinand A. Kroger, R. J. Brook, P. B. P. Phipps, Y. J. van der Meulen, H. Yanagida et al 30 Sep. 1969 12 p refs
(Grants AF-AFOSR-986-66; AF-AFOSR-68-1405)
(AD-701437; AFOSR-70-0443TR) Avail: CFSTI CSCL 7/4

The report gives a brief review of research under the headings: Silver halide studies (polarization; optical absorption); NH4Cl (mixed ion-proton-electron conductivity); Electrochemistry of stabilized zirconia (use as oxygen pump, electrode behavior); Pyrex as solid electrolyte (used to measure activities in Na-Sn alloys and as oxygen or sulfur pressure gauge; Al2O3 Studies; the system Al-O; transference studies; and Defect Chemistry (role in characterization of materials, stability of transition metal compounds, defect model for UO2). TAB

N70-27101# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
SEPARATION AND PURIFICATION SECTION: SUMMARY OF ACTIVITIES, JULY 1968 TO JUNE 1969
David H. Freeman and Walter L. Zielinski, Jr., eds. Feb. 1970 69 p refs
(NBS-TN-509) Avail: SOD $0.70 Catalog No. C13.46:509

CONTENTS:
1. ION EXCHANGE MICROSTANDARDS p 1-12 ref (See N70-27102 13-06)
2. ION EXCHANGE SUBSTRATES p 13-30 ref (See N70-27103 13-06)
3. COPOLYMER AND ION EXCHANGE MICROSCOPY p 30-34 (See N70-27104 13-06)
4. CHROMATOGRAPHY p 35-52 (See N70-27105 13-06)
5. REAGENTS p 53-57 (See N70-27106 13-06)

N70-27102# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
ION EXCHANGE MICROSTANDARDS
In its Separation and Purif. Sect. Feb. 1970 p 1-12 ref (See N70-27101 13-06)
Avail: SOD $0.70 Catalog No. C13.46:509

The annual progress of the Separation and Purification Section activities is reported. The major task of developing a certified ion exchange microstandard as a Standard Reference Material is presented in terms of the preparative and characterizational work involved. Optical microscopy is applied to the study of swelling kinetics for single copolymer particles. Analytical gas chromatography is applied to the isomers of divinylbenzene. The recently acquired quadrupole mass spectrometer is described. Liquid chromatography at high pressures and with high resolution has been begun recently. The activities of a project dealing exclusively with ultrapure reagents are described including the problems of storage contamination. Author

N70-27103# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
ION EXCHANGE SUBSTRATES
In its Separation and Purif. Sect. Feb. 1970 p 13-30 ref (See N70-27101 13-06)
Avail: SOD $0.70 Catalog No. C13.46:509

The synthesis, characterization, and the structure of sulfonated poly(styrene/DVB) are investigated to provide stable, reproducible copolymer beads for use in microstandards. The preparation, sulfonation with DVB crosslinking, and the infrared spectrophotometry of copolymers are described. F.O.S.

N70-27104# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
COPOLYMER AND ION EXCHANGE MICROSCOPY
In its Separation and Purif. Sect. Feb. 1970 p 30-34 (See N70-27101 13-06)
Avail: SOD $0.70 Catalog No. C13.46:509

The techniques and equipment which were used in the microscopy laboratory to obtain satisfactory results with microstandard particles are described. The criteria normally used to reject materials from further study for use as ion exchange material are listed, and the characterization of accepted materials by swelling of particles in various organic solvents are discussed. The capability of the microscopy facility to observe defects, measure bead diameters with precision, and perform transfers of loaded ion exchange particles, is considered a necessary and unique function in the Ion Exchange Microstandard program. F.O.S.

N70-27105# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
CHROMATOGRAPHY
In its Separation and Purif. Sect. Feb. 1970 p 35-52 (See N70-27101 13-06)
Avail: SOD $0.70 Catalog No. C13.46:509

The chromatographic separation of divinylbenzene (DVB) by the Bentone-34, and the liquid crystal methods is investigated for use in preparing crosslinked poly(styrene/DVB) copolymers. Other topics of gas chromatography include: quadrupole mass spectrometer, gas chromatography and mass spectrometer interface, and liquid chromatography. F.O.S.

N70-27106# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
REAGENTS
In its Separation and Purif. Sect. Feb. 1970 p 53-57 (See N70-27101 13-06)
Avail: SOD $0.70 Catalog No. C13.46:509

The research in contamination removal for achieving ultrapurity in reagents is described. The increasing use of ultrapure reagents is discussed, and the number of units dispensed in FY 1969 are listed. F.O.S.

N70-27131*# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
THE COMBUSTION OF THE ALKALINE EARTH METALS IN CARBON DIOXIDE
Robert Clarke Brown 1969 81 p refs
(Grant NGR-31-001-129)
(NASA-CR-109844; TR-879) Avail: CFSTI CSCL 07D

Three of the alkaline earth metals (Mg, Ca, and Sr) were burned in CO2 using a two dimensional diffusion flame burner similar to that of Sullivan. Diagnostic techniques employed were visual, spectral, and photographic. This work was compared with Sullivan's investigation of the same metals reacting in O2. It is shown that Ca and Sr burn in a homogeneous, vapor phase reaction and fit Sullivan's model well, while Mg burns heterogeneously in the vapor phase, making Sullivan's model inapplicable. In all three cases the vapor phase reaction reduces the CO2 to CO rather than to C. Author

N70-27148# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Biochemistry.
A STUDY OF INTERMEDIARY METABOLISM OF CARBOHYDRATES WITH ISOTOPICALLY LABELED COMPOUNDS Progress Report
Harland G. Wood 15 Sep. 1969 29 p refs
(Contract AT(11-1)-1783)
(COO-1783-2) Avail: CFSTI

Mechanisms are postulated for three reactions concerning the intermediary metabolism of carbohydrates with isotopically labeled compounds. Specifically these reactions include carboxytransphosphorylase, pyruvate with phosphate dikinase, and the synthesis of acetate from CO2 by Clostridium thermoaceticum. S.S.

N70-27156# Ohio State Univ. Research Foundation, Columbus.
KNUDSEN AND MOLECULAR DIFFUSION OF GASES IN CAPILLARIES AND POROUS SOLIDS OVER LARGE PRESSURE RANGES Technical Progress Report, 1 Apr. 1969 - 31 Mar. 1970

Christie J. Geankoplis 28 Nov. 1969 34 p refs
(Contract AT(11-1)-1675)
(COO-1675-9) Avail: CFSTI

Experimental data were recently obtained in this laboratory for diffusion of binary gases in different synthetic porous structures of compressed alumina powder. Solids made and used were one which contained one micropore size and many macropore sizes, several solids where the micropore structure was constant but the macropore radius was varied, and a solid where some of the micropores were blocked off by glass powder particles. Theoretical equations derived for these cases checked the experimental data. The data covered a 1300/1 pressure range which included the Knudsen and most of the transition region. A method was devised to make a plug containing 272 straight glass capillaries in parallel. Two preliminary experimental diffusion runs were made in the transition region and checked the theoretical transition region equation reasonably well. An analytical solution to the differential equations for diffusion of a three-component gas mixture was obtained for the complete transition region in an open system. Author

N70-27157# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Biochemistry.

A STUDY OF INTERMEDIARY METABOLISM WITH ISOTOPICALLY LABELED COMPOUNDS Comprehensive Report, Sep. 1966 - Sep. 1969

Harland G. Wood 15 Sep. 1969 21 p refs
(Contracts AT(30-1)-1320; AT(11-1)-1783)
(COO-1783-3) Avail: CFSTI

The objectives are to study the intermediary metabolism of carbohydrates and to determine the mechanism of these reactions using labeled compounds and purified enzymes. The role of coenzymes, metals, the properties and structures of the active sites of the enzymes are being investigated as a means of understanding catalysis and the control of metabolism. The emphasis is on the mechanisms of the utilization of carbon dioxide, the intermediate compounds involved in these utilizations and the detailed chemistry of the reactions. Author

N70-27173# Army Electronics Command, Fort Monmouth, N.J. Electronics Components Lab.

SOLUBILITY OF PROPANE IN AQUEOUS SOLUTIONS

John A. Christopulos Dec. 1969 15 p refs
(AD-700958; ECOM-3211) Avail: CFSTI CSCL 7/4

A new method is disclosed for the quantitative determination of propane in water, perchloric, sulfuric, phosphoric and trifluoroacetic acid solutions at various temperatures. The solubility of propane in water and all 1 molar acids except sulfuric acid appeared to be temperature dependent in the range of 20-40C. Sulfuric acid anions apparently change the association of water molecules into a more stable homogeneous arrangement which is temperature independent between 20-65C with respect to propane solubility. Author (TAB)

N70-27189# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.

NUCLEAR CHEMISTRY

In its Radiochem. Analysis Sect. Feb. 1970 p 52 88 (See N70-27187 13-24)
Avail: SOD $1.25 Catalog No. C13.46:501

Nuclear reaction studies are supported by statistical investigations to improve the accuracy of resulting conclusions by finding superior methods for treating experimental data. Least squares solutions to over-determined systems are applied to parameter estimates, standard errors, and various measures of the quality of the fit of the set of observations to the model in individual radionuclide contributions to observed composite gamma-ray spectra. Examples are given for the gain shift problem and the estimation of variance. R.B.

N70-27207# George Washington Univ., Washington, D.C. Dept. of Chemistry.

LANTHANIDE IONS AS SENSITIVE PROBES IN INTERMOLECULAR ENERGY TRANSFER AND ORGANIC PHOTOCHEMISTRY Annual Progress Report

Nicolae Filipescu Jan. 1970 5 p
(Contract AT(40-1)-3797)
(ORO-3797-3) Avail: CFSTI

Substantial progress has been made in four directions: (1) energy transfer from organic triplets to trivalent europic ions in rigid matrix, (2) statistical treatment of exchange transfer and development of a new transfer model, (3) study of energy transfer in purposely synthesized model compounds, and (4) photolysis of metal chelates. Results are summarized. Author

N70-27211# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

RADIATION CHEMISTRY OF MONO-SUBSTITUTED AROMATIC COMPOUNDS Progress Report, 15 Jan. 1969 - 15 Jan. 1970

J. A. Knight, Jr. 28 Jan. 1970 22 p
(Contract AT(40-1)-3519)
(ORO-3519-6) Avail: CFSTI

Studies are being made of the radiolysis of nitrobenzene. In the gamma radiolysis of nitrobenzene, the carbon-nitrogen bond is the most susceptible to scission followed by the nitrogen-oxygen bond of the nitro group, and the carbon-hydrogen bond is the least susceptible to radiolytic scission. In the gamma-radiolysis of aniline, the gases identified to date are hydrogen, G = 0.11, and ammonia, G = 0.15. Based on G values of products obtained to date, the radiolytic gases, hydrogen and ammonia, are the most important products. The hydrogen yield is about three times as great as the hydrogen yield from gamma-irradiated benzene and was not affected by anthracene, naphthalene, or biphenyl at the concentrations tested. The formation of ammonia shows that the carbon-nitrogen bond is susceptible to radiolytic scission. Benzene, G = 0.021, is the only product identified to data which appears before aniline on the gas chromatograms. The phenylenediamines were not definitely detected as radiolytic products. If the phenylenediamines are present, they constitute minor radiolytic products with G values of less than 0.0001. Data indicate that the phenylation of aniline is not a major process in gamma-irradiated aniline. NSA

N70-27216# Arizona Univ., Tucson. Dept. of Chemistry.

[LUMINESCENCE OF PYRIDINES. POLARIZATION OF THE PHOSPHORESCENCE OF NITROAROMATIC MOLECULES. A NEW METHOD FOR MEASURING PHOSPHORESCENCE] Technical Progress Report

V. G. Krishna 31 Jan. 1970 6 p refs
(Contract AT(11-1)-1792)
(COO-1792-4) Avail: CFSTI

Progress is reported on the emission properties of pyridine, a method for measuring phosphorescence of glass samples, and photoselection techniques for measuring the polarization of nitroaromatic molecule phosphorescence. R.B.

N70-27220# Pennsylvania State Univ., University Park. Dept. of Materials Science.

A PRELIMINARY STUDY OF EXCHANGE OF C ATOMS BETWEEN CO AND GRAPHON

Roger Phillips, F. J. Vastola, and P. L. Walker, Jr. Nov. 1969 23 p refs
(Contract AT(30-1)-1710)
(NYO-1710-96) Avail: CFSTI

The exchange of C atoms between CO and Graphon samples has been studied. Samples between zero and 36% burn-off and temperatures between 800 and 950 C were used. C-13 was employed as a tracer and mass spectroscopy as the analytical tool. The exchange followed a simple kinetic scheme. It was possible to measure the concentration of active sites, rate constants, and

the activation energy for the exchange, which was found to be 55 kcal/mole between 800 and 850 C. The concentration of active sites was found to be quite variable from sample to sample, with the major determining factor being the exact conditions under which the previous increment of burn-off had been performed rather than the actual degree of burn-off. Following exchange, gasification of the surface with O2 was used to retrieve the C-13 deposited on the surface during the exchange. Major factors influencing the ease of retrieval were found to be sample burn-off and the temperature of exchange. Author

N70-27277 National Lending Library for Science and Technology, Boston Spa (England).
AGGREGATE STABILITY OF Ti-O2 HYDRODISPERSIONS IN PRESENCE OF VARIOUS SURFACE ACTIVE SUBSTANCES [AGREGATIVNAYA USTOICHIVOST GIDRODISPERSII TiO2 V PRISUTSVII RAZLICHNYKH POVERKHNOSTNOAKTIVNYKH VESCHESTV]
V. L. Maksimov et al Feb. 1970 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol. (Moscow), v. 11, no. 11, 1968 p 1247 - 1252
(NLL-RTS-5523) Avail: Natl. Lending Library, Boston Spa, Engl.: 15s or 2 NLL photocopy coupons

Commercial anatase TiO2 containing electrolyte admixtures, the ions of which alter the surface of TiO2 particles and their adsorption capacity, was subjected to electrodialysis. The experiments show that the suspensions can be stabilized by ionic-solvate as well as structural lyophilic molecular layers. The value of sigma-potential can in many cases be used as an index of stability of colloidal systems. Zeta-potential is related to the thickness of the double layer and the thickness of the ionic-solvate layers. The prevailing factor in stabilization depends on the physicochemical properties of the surfactant, its concentration, and the surface state of the adsorbent. Author

N70-27284*# Translation Consultants, Ltd., Arlington, Va.
ON THE DECOMPOSITION OF CARBIDES THROUGH WATER OR DILUTED ACIDS [UEBER DIE ZERSETZUNG VON CARBIDEN DURCH WASSER ODER VERDUENNTE SAEUREN]
J. Schmidt Washington NASA Mar. 1970 9 p refs Transl. into ENGLISH from Z. Elektrochem. (Weinheim), v. 40, no. 4, 1934 p 170 - 174
(Contract NASw-2038)
(NASA-TT-F-12874) Avail: CFSTI CSCL 07D

Carbides which can be decomposed through water or diluted acids can be divided into three groups. The first group consists of the carbides of ferrous metals and manganese with the formula Me3C and probably the aluminum carbide Al4O3. Acetylene is not produced when these carbides are decomposed. The second group consists of carbides which produce acetylene when they are decomposed. The carbides of the alkaline and alkaline earth metals along with the carbides Al2(C≡C)3 and Ce2(C≡C)3 belong to this group. The carbides of the rare earth elements and uranium also belong to this group, but they produce other unsaturated and saturated hydrocarbons in addition to acetylene when they are decomposed. The third group is made up of carbides which produce propyne when they are decomposed. Mg2C3 is the only known carbide which belongs to this group. Author

N70-27286*# Techtran Corp., Glen Burnie, Md.
CHARGE CURVES OBTAINED DURING ANODIC OXIDATION OF ALUMINUM IN SULFURIC ACID SOLUTIONS [KRIVYYE ZARYAZHENIYA PRI ANODNOM OKISLENII ALYUMINIYA V RASTVORAKH SERNOY KISLOTY]
A. P. Vedernikov Washington NASA Apr. 1970 13 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst., Ser. Khim. (Kazan), no. 90, 1966 p 41 - 50
(Contract NASw-2037)
(NASA-TT-F-12596) Avail: CFSTI CSCL 07D

Charge and discharge curves for the anodic oxidation of aluminum in sulfuric acid solutions are obtained. The resistance of the oxide film during its growth is calculated and it is found that the films produced with low current densities possess higher resistance. The presence of several stages on the discharge curves, related to specific electrochemical processes, is noted. It is shown that the charge curve method can be used for the investigation of the electrochemical processes on aluminum. Author

N70-27287*# Techtran Corp., Glen Burnie, Md.
PROBLEMS ASSOCIATED WITH THE SORPTION OF ANIONS BY AN ANODIC OXIDE FILM ON ALUMINUM IN AQUEOUS SOLUTIONS OF INORGANIC SALTS [NEKOTORYYE VOPROSY SORBTSII ANIONOV ANODNOY OKISNOY PLENKOY NA ALYUMINII V VODNYKH RASTVORAKH NEORGANICHESKIKH SOLEY]
V. T. Belov Washington NASA Apr. 1970 8 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst., Ser. Khim. (Kazan), no. 90, 1966 p 25 - 31
(Contract NASw-2037)
(NASA-TT-F-12594) Avail: CFSTI CSCL 07D

The processes that occur during charging of hot aqueous solutions of inorganic salts with anodic aluminum oxide films are discussed. The possible causes of reduced sorption of anions of anodic oxide film on aluminum with increasing pH of the solution filler are considered: change in magnitude of the surface of the film during filling; change in the state of the film surface in the solution; change in the state of the anion adsorbed by the film during filling. Author

N70-27288*# National Aeronautics and Space Administration, Washington, D.C.
SALT COMPOSITION OF ANODIC OXIDE FILMS ON ALUMINUM FROM THERMOGRAPHIC ANALYSIS DATA [SOLENOY SOSTAV ANODNYKH OKISNYKH PLENOK NA ALYUMINII PO DANNYM TERMOGRAFICHESKOGO ANALIZA]
A. F. Bogoyavlenskiy et al Apr. 1970 11 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst., Ser. Khim. (Kazan), no. 90, 1966 p 32-40
(NASA-TT-F-12595) Avail: CFSTI CSCL 07D

The thermography technique was used to study the composition of anodic films. The resulting thermograms were compared with the thermograms of salts. The formation in the corresponding anodic films of the sulfate was demonstrated. The thermography technique was used to detect crystalline modification transition. Author

N70-27289*# Scientific Translation Service, Santa Barbara, Calif.
EFFECT OF CURRENT REVERSAL ON COMPOSITION AND PROPERTIES OF ANODIC OXIDE FILM ON ALUMINUM FROM TRACER ATOM DATA. ROLE OF PHYSICAL PARAMETERS OF THE PROCESS IN THE PENETRATION OF THE ELECTROLYTE ANION INTO THE ANODIC FILM [VLIYANIYE REVERSA TOKA NA SOSTAV I SVOYSTVA ANODNOY OKISNOY PLENKI NA ALYUMINII PO DANNYM METODA MECHENYKH ATOMOV. ROL FIZICHESKIKH PARAMETROV PROTSESSA PRI VNEDRENII ANIONA ELECTROLITA V ANODNYYU PLENKU]
L. S. Rachevskaya et al Washington NASA Apr. 1970 11 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst., Ser. Khim. (Kazan), no. 90, 1966 p 16 - 24
(Contract NASw-2035)
(NASA-TT-F-12593) Avail: CFSTI CSCL 07D

The influence of process time, electrolyte bath concentration and temperature, as well as electric current voltage on the film characteristics of aluminum oxide films was studied experimentally.

Total anodic and cathodic periods were 40 minutes each, as in previous experiments. Radioactive PO4(−3) in phosphoric acid was used as a tracer and was found to increase by current reversal. Author

N70-27307 National Lending Library for Science and Technology, Boston Spa (England).
THE PROBLEM OF THE MECHANISM OF LIQUID PHASE AUTOXIDATION OF p-XYLENE [K VOPROSU O MEKHANIZME ZHIDKOFAZNOGO AVTOOKISLENIYA P-KSILOLA]
E. K. Varfolomeeva Feb. 1970 10 p refs Transl. into ENGLISH from Ukr. Khim. Zh. (Kiev), v. 20, no. 1, 1954 p 25–30
(NLL-RTS-5669) Avail: Natl. Lending Library, Boston Spa, Engl.: 15s or 2 NLL photocopy coupons

The effects of catalysts for hydrocarbon liquid phase oxidation on the intermediate phases in the oxidation process, on the formation of organic peroxides, and on their thermal decomposotion are studied. Hydroquinone and p-hydroxydiphenylamine were used as oxidation inhibitors, and amyl nitrite and manganese naphthenate as positive oxidation catalysts. The experiments show that autoxidation of p-xylene obeys an approximately first order kinetic equation, and that the oxidation inhibitors retard both intermediate stages of the reaction of autoxidation of p-xylene, the organic peroxides formation stage, and the thermal decomposition stage. Author

N70-27342*# Techtran Corp., Glen Burnie, Md.
CERTAIN PECULIARITIES OF THE ANODIC OXIDATION OF ALUMINUM IN SODIUM CARBONATE SOLUTIONS [NEKOTORYYE OSOBENNOSTI ANODNOGO OKISLENIYA ALYUMINIYA V RASTVORAKH KARBONATA NATRIYA]
G. N. Dobrotvorskiy Washington NASA Apr. 1970 10 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst., Ser. Khim. (USSR), no. 90, 1966 p 8–15
(Contract NASw-2037)
(NASA-TT-F-12592) Avail: CFSTI CSCL 07D

The features of anodic oxidation of aluminum in sodium carbonate solutions, including pH, high voltage required for formation of the oxide layer, and their effect on the processes that occur in the oxide film were investigated. The relationship between the voltage and the number of electrolytic ions in the oxide film was established. The distribution of active ions in films obtained by alternating oxidation of aluminum in sodium carbonate solutions was investigated by the tagging method with C-14 isotope. Author

N70-27353# IIT Research Inst., Chicago, Ill.
KINETICS OF SYNTHESIS AND DECOMPOSITION REACTIONS OF IONIC COMPOUNDS CONTAINING N-F CATIONS Annual Summary Report, 1 Feb. 1969–31 Jan. 1970
Irvine J. Solomon and James N. Keith 13 Feb. 1970 27 p
(Contract N00014-68-C-0279)
(AD-701754; IITRI-C6140-4) Avail: CFSTI CSCL 7/4

Kinetic studies have been made of the decomposition of NF4AsF6 in a Monel system. The data are interpreted in terms of an equilibrium dissociation. Values for the product K1K(eq) are presented for the range 175 to 240C, from which the sum delta H(a) + E(a) is found to be 50 kcal/mole. Preliminary results from a matrix isolation study of the decomposition of NF4AsF6 indicate that, besides NF3 and AsF5 a small amount of an unidentified compound is present. The new lines have not yet been correlated with the spectrum of any known compound. Ammonium perbromate, NH4BrO4, has been prepared, and some of its physical and chemical properties examined. It is rather similar to NH4ClO4, though somewhat less stable. Author (TAB)

N70-27380*# Dynamic Science, Irvine, Calif.
A BASIC STUDY OF THE IGNITION OF HYPERGOLIC LIQUID PROPELLANTS Final Report
L. B. Zung and B. P. Breen 12 Feb. 1970 96 p refs
(Contract NAS7-438)
(NASA-CR-109837; SN-80-F) Avail: CFSTI CSCL 21I

Ignition studies of hydrazine and nitrogen tetroxide were conducted and an ignition burner based on the stagnation flow field was developed. Effects of flow Reynolds number, burner pressure, oxidizer temperature, and hydrazine water content were evaluated. For a 30% increase in flow velocity, it was observed that the threshold concentration of nitrogen dioxide increases by about 20%. It was found that for hydrazine temperature under approximately 310 K, the vapor pressure of hydrazine was not high enough to sustain a vapor phase ignition. Reactions between nitrogen dioxide and liquid hydrazine were significant as evidenced by foaming and bubbling observed on the liquid surface. Heat release associated with these reactions gradually raised the hydrazine temperature which in turn led to a vapor phase ignition. Main gaseous products were found to be N2O, NO, N2, and H2O. A theoretical study to understand the ignition of liquid fuel was carried out. Based on the stagnation flow field, the governing partial differential equations were reduced to a set of ordinary differential equations. The species concentrations and temperature profiles of the nonreactive flows were used to describe the rate of reaction prior to ignition. Author

N70-27407# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
STEADY-STATE CHEMICAL POTENTIAL PROFILES IN SOLID ELECTROLYTES
Nabendu S. Choudhury and John W. Patterson Feb. 1970 26 p refs
(Contract F33615-68-C-1034; Proj. Themis)
(AD-702520; ISU-ERI-AMES-67100) Avail: CFSTI CSCL 7/4

Steady-state chemical potential profiles in a solid electrolyte under open circuit and ion blocking conditions, may be obtained by balancing the steady-state flux at points inside the electrolyte. Steady-state oxygen chemical potential profiles inside a scaling layer of Thoria and inside Yttria doped Thoria specimens under open circuit and ion blocking (dc polarization) conditions are illustrated in special cases. Author (TAB)

N70-27416# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
DETERMINATION OF GADOLINIUM IN IRRADIATED GADOLINIA-MAGNESIA MIXTURES
I. H. Robins and D. A. Hilton Jan. 1970 8 p refs
(RD/B/N-1499) Avail: AEC Depository Libraries

Gadolinium is determined in irradiated Gd2O3-MgO mixtures by titrating an acetic acid solution of these oxides with sodium oxalate. The Gd-153 activity in solution is used as an internal indicator and this is measured at regular intervals throughout the titration by high resolution gamma spectrometry, until complete precipitation of gadolinium oxalate is obtained. The acetate ions in solution have little effect on the overall reaction and the proposed method has an accuracy and precision of the order of 0.5 per cent. Author (NSA)

N70-27417# Oak Ridge National Lab., Tenn.
A MATHEMATICAL MODEL AND A COMPUTER PROGRAM FOR ESTIMATING DISTRIBUTION COEFFICIENTS FOR PLUTONIUM, URANIUM, AND NITRIC ACID IN EXTRACTIONS WITH TRI-N-BUTYL PHOSPHATE
D. E. Horner Feb. 1970 27 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2711) Avail: CFSTI

On the basis of the equilibria involved in the solvent extraction of plutonium, uranium, and nitric acid with tri-n-butyl phosphate (TBP), an empirical mathematical model and a FORTRAN program were developed to allow computer calculation of estimated distribution coefficients. For the 15% TBP system, good agreement

was shown between experimentally obtained distribution coefficients that were fitted to the model and the calculated coefficients. Author (NSA)

N70-27424# Oak Ridge National Lab., Tenn.
THERMAL REACTIONS OF IODINE WITH OLEFINS, AND RADIATION-INDUCED REACTIONS WITH PARAFFINS. A BRIEF LITERATURE SURVEY PERTINENT TO LMFBR FUEL PROCESSING
Wallace Davis, Jr. Dec. 1969 16 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2772) Avail: CFSTI

Available data on reactions of iodine with olefins and with free radicals produced by the radiolysis of hydrocarbons are summarized. Very little reaction of iodine with olefinic impurities would be expected at the low iodine and olefin concentrations assumed to be present in the first cycle of a tributyl phosphate-n-paraffin solution used for LMFBR fuel processing. However, even with oxygen dissolved in the organic solution, extensive to nearly complete reaction of iodine with hydrocarbon free radicals would probably occur at radiation doses much less than the likely normal maximum of 0.5 whr/liter. Author (NSA)

N70-27425*# Scientific Translation Service, Santa Barbara, Calif.
ELECTRON PROPERTIES OF THE HYDRIDES OF Ti-H AND Zr-H SYSTEMS [PROPRIETES ELECTRONIQUES DES HYDRURES DES SYSTEMES Ti-H ET Zr-H]
F. Ducastelle et al Washington NASA Apr. 1970 19 p refs
Transl. into ENGLISH of French report ONERA-TP-718
(Contract NASw-2035)
(NASA-TT-F-12937) Avail: CFSTI CSCL 07D

The electronic specific heat, the magnetic susceptibility and the thermoelectric power of compounds of the Ti-H and Zr-H systems with high hydrogen content have been measured. The results are consistent with the presence of a high density d-character narrow band at the Fermi level. Moreover, they show a strong dependence of the electronic properties on crystal structure, which can be attributed to a John-Teller type effect, the deformation of the density of states distribution N(E) leading to a lower total energy of the quadratic phase of high hydrogen contents. A rough model of these band deformations is proposed for both systems. Author

N70-27430# Fordham Univ., New York. Dept. of Chemistry.
KINETICS AND STRUCTURAL STUDIES OF CHELATES BETA-DIKETONES WITH TRANSITION AND RARE METALS
Progress Report, 1 Apr. 1969 - 31 Mar. 1970
Michael Cefola 21 Jan. 1970 39 p refs
(Contract AT(30-1)-906)
(NYO-906-87) Avail: CFSTI

Sturctural studies of coordination compounds included: (1) the crystal and molecular structure of ammonium tris(4,4,4-trifluoro-1-(2-furyl)-1,3-butadione) cadmium(II); (2) preparation and X-ray single crystal study of diaquopraeseodymium monothiothienyl-trifluoracetone and dithienyl-trifluoroacetone; and (3) the preparation and preliminary studies of some rare earth tetrabutylammonium chelates. Kinetics of the formation and dissociation of some beta-diketone acetone complexes of nickel(II) and iron(III) was also investigated. S.S.

N70-27462# Aberdeen Research and Development Center, Aberdeen Proving Ground, Md. Coating and Chemical Lab.
PERFORMANCE CHARACTERISTICS OF CYANOETHYL PHASES FOR USE IN GAS-LIQUID CHROMATOGRAPHY
Final Report
George G. Esposito and Robert Jamison Jan. 1970 14 p refs
(AD-701891; CCL-276) Avail: CFSTI CSCL 7/4

Commercially available cyanoethyl type liquid phases have been compared for their aromatic-aliphatic selectivity. In addition, column efficiency and ethyl benzene-xylene resolution were determined and tabulated. It was found that cyanoethyl liquid phases have widely divergent performance characteristics and for certain problems, specific phases are preferred. Author (TAB)

N70-27464# ARO, Inc., Arnold Air Force Station, Tenn.
SORPTION PUMPING HYDROGEN BY CRYODEPOSITS - PREDICTION OF SORPTION CAPACITY
Final Report, Apr. - Sep. 1969
K. F. Tempelmeyer Feb. 1970 45 p refs
(Contract F40600-69-C-0001)
(AD-700981; AEDC-TR-69-270) Avail: CFSTI CSCL 7/4

The applicability of several existing adsorption theories for predicting the equilibrium isotherms for the sorption of hydrogen (H2) by carbon dioxide (CO2) cryodeposits has been examined in the pressure range from 10 to the - 8th power to 10 to the -3rd power torr. It is demonstrated that the H2 sorption capacity of CO2 frost cryosorbents at temperatures between 12 and 20K may be accurately predicted by an equilibrium isotherm equation proposed by Dubinin and Radushkevich. This equation is then used to calculate families of sorption isotherms for CO2 frosts formed at various conditions and consequently having different structures. These results may be used to estimate the H2 capacity of cryosorption pumping systems which would employ CO2 frost as a cryosorbent. Author (TAB)

N70-27467# Sandia Corp., Albuquerque, N.Mex.
FUSED SALT MIXTURES: SPECIFIC CONDUCTIVITY TABLES
Paul V. Clark Oct. 1969 433 p refs
(SC-R-69-1386) Avail: CFSTI

The current coverage includes all apparently reliable data up through August 1968. In these tables specific conductance values for some 270 fused salt systems are presented as a function of composition and temperature. In a majority of cases, a system will have been reported only once. However, in instances of multiple reports, each seemingly reliable report was included. The value of an added case, though the data may be limited, is apparent. The systems are written in alphabetical order by formula and all two-component systems report the percentage of the first component only. Author (NSA)

N70-27497# New England Inst. for Medical Research, Ridgefield, Conn.
POSITRON ANNIHILATION IN POLYMERS OF VARIOUS MOLECULAR WEIGHTS
S. J. Tao and S. Y. Chuang Jun. 1969 16 p refs
(Contract AT(30-1)-3661)
(TID-25309) Avail: CFSTI

The mean lives of positron annihilation in samples of several polymers of various molecular weights are measured. The systematic relation between the mean life and the molecular weight of the polymer is discussed. Author

N70-27502# Nuclear Materials and Equipment Corp., Lewiston, N.Y. Niagara Div.
DETERMINATION OF THE RHOMBIC TO CUBIC TRANSITION TEMPERATURES OF THE ALKALI METAL TETRAFLUOROBORATES USING DIFFERENTIAL THERMAL ANALYSIS
R. T. Marano and E. R. Shuster 9 Dec. 1969 18 p refs
(Contract AT(40-1)-3292)
(NUMEC-3292-15) Avail: CFSTI

A systematic investigation of the rhombic-to-cubic transition temperatures of the alkali metal tetrafluoroborates using differential thermal analysis (DTA) is reported. This transition has previously been reported on NaBF4 and KBF4, both measured by X-ray diffraction techniques more than twenty years ago, without independent confirmation. Author

N70-27505# Michigan State Univ., East Lansing.
ELECTROCHEMISTRY AND SPECTRA OF METAL-AMMONIA AND METAL-AMINE SOLUTIONS AND KINETICS OF ELECTRON-ATTACHMENT REACTIONS
Technical Progress Report, 16 Sep. 1968 - 15 Sep. 1969
15 Sep. 1969 14 p refs
(Contract AT(11-1)-958)
(COO-958-15) Avail: CFSTI

The results of an optical spectra study of metal solutes in aliphatic amines were examined. Kinetics of cesium ethylenediamine and water, EPR spectra of metal amines, and calculations on LiNH3 and Li(NH3)2 molecular orbitals were presented. Proton transfer to aromatic radical anions was studied with anthracene in tetrahydrofuran. S.S.

N70-27512# University of Southern Calif., Los Angeles.
THE RATE OF OXIDATION OF Hg2(2+) BY S2O8(--) IN AQUEOUS SOLUTION
N. V. Raghavan and W. K. Wilmarth [1969] 23 p
(USC-113-P-4-15) Avail: CFSTI

A study was made of the rate of oxidation of Hg2(2+) by S2O8(--) at 25 deg. 0.30 ionic strength, and over a range of acidity at 0.01 to 0.20 M. In both O2 free and oxygen saturated solutions the rate is first order in S2O8(--), half order in Hg2(2+), and zero order in H(+) and Hg(2+). When the solution is saturated with O2 at pressures of 0.50 to 1.0 atm., the rate is essentially zero order in O2, but is a factor of 5.8 slower than O2 free solutions. The form of the rate low and the marked decrease in rate observable in the presence of trace impurities indicates that the reaction is proceeding by a chain mechanism. Author

N70-27581# Wayne State Univ., Detroit, Mich. Dept. of Chemistry.
POLYMERIZATION ON CARBON BLACK SURFACES
H. K. Livingston, Raymond Senkus, and John T.-T. Hsieh 29 Dec. 1969 13 p refs
(Contract AT(11-1)-1580)
(COO-1580-8) Avail: CFSTI

The polymerization of monomers adsorbed on carbon lack is of interest because the orienting effect of the solid surface on the monomer molecules can have a directing effect on polymerization. There are preliminary indications that this is actually observed in the case of furan. An irreversible adsorption, believed to be a polymerization, occurs to the extent of 10 - 30% of the adsorbed furan per hour at 25 C. and half a monolayer. Lowering the temperature of the adsorbing surface did not prevent the irreversible adsorption. The phenomenon of irreversible adsorption is not limited to furan on carbon black; 1,4-cyclohexadiene also undergoes irreversible adsorption on carbon black. Author

N70-27583 Paris Univ. (France). Faculte des Sciences.
CONTRIBUTION TO THE STUDY OF FLUORESCENT RADIATION IN THE SOFT X-RAY RANGE [CONTRIBUTION A L'ETUDE DU RAYONNEMENT DE FLUORESCENCE DANS LE DOMAINE DES RAYONS X MOUS]
Christiane Senemaud (Ph.D. Thesis) 1968 146 p refs In FRENCH
Avail: Issuing Activity

The K spectra of aluminum, magnesium and sodium were studied using fluorescent radiation. The principal characteristics of an universal X-ray spectrograph and its modification for fluorescent radiation as a function of the conditions of observation are discussed. The measurements of the wavelengths of the K alpha sub 1 and K alpha sub 2 lines using fluorescent radiation as well as a comparative study of the satellite emissions accompanying this doublet when excited by either electrons or photons are presented. Study of the K beta emission band and K absorption spectra gave some data on the band structure of aluminum, magnesium and their oxides. ESRO

N70-27593# Reactor Centrum Nederland, Petten.
THE PROPERTIES OF TRILAURYLMETHYLAMMONIUM NITRATE AS AN EXTRACTANT FOR TRIVALENT ACTINIDES
J. van Ooyen Mar. 1970 105 p refs
(Contract EURATOM-008-65-10-TPUN)
(RCN-113) Avail: CFSTI

The extraction of trivalent Ac, Pu, Am, Cm, Bk, Cf, Es, Ce, and Eu from acidified lithium nitrate solutions into TLMANO3/o-xylene is investigated. The extraction properties of TLMANO3 are largely influenced by its acid binding properties and the formation of oligomers in solution. The existence of the complex TLMANO3.HNO3 is substantiated by potentiometric two-phase titrations, the formation of oligomers by differential vapor pressure measurements. TLMANO3 in o-xylene solution forms dimers, trimers, and higher oligomers, mainly pentamers. In the metal complexes two organic ligands are present per metal ion and these ligands can be monomers, dimers, or trimers, but no higher oligomers. A separation of Am and Cm by column extraction chromatography is described which gives a separation factor of 3.5 Author (ESRO)

N70-27603# Indiana Univ., Bloomington. Dept. of Chemistry.
CHEMICAL AND PHYSICAL STUDIES OF CYCLOBORAZANES Final Report, 1 Jul. 1961 - 31 Aug. 1969
Riley Schaeffer 1970 67 p refs
(Grants DA-ARO(D)-31-124-G99; DA-ARO(D)-31-124-G556)
(AD-701129; AROD-3100-7-C) Avail: CFSTI CSCL 7/3

The report is comprized of five articles submitted for publication on cycloborazanes. The articles are the following: Studies of boron-nitrogen compounds XI. Reaction of carbon atoms with boron-nitrogen compounds; Studies of boron-nitrogen compounds XII. The preparation and properties of azidodihydroborane, H2BN3; Studies of boron-nitrogen compounds XIII. Reactions of boron-nitrogen compounds with hydrazoic acid; Studies of boron-nitrogen compounds XIV. Some properties of boron azides; and Studies of boron-nitrogen compounds XV. Reduction of aldehydes. TAB

N70-27613 National Lending Library for Science and Technology, Boston Spa (England).
SOLUBILITY OF NITROGEN IN MOLTEN NICKEL ALLOYS
A. Y. Stomakhin et al 15 Jan. 1969 14 p refs Transl. into ENGLISH from Fiz.-Khim. Osnovy Proizv. Stali, Akad. Nauk SSSR, Inst. Met. (Moscow), 1968 p 292 295 In RUSSIAN and ENGLISH
(NLL-Trans-746-319-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The solubility of nitrogen in pure molten nickel and in binary nickel alloys containing admixtures of technically important elements was investigated. These elements were chromium, molybdenum, and tungsten from group 6, and titanium and aluminum which form stable nitrides. It was determined from experiment and previous published data that the solubilities of nitrogen and carbon are energetically more difficult in nickel and cobalt than in iron. This is explained by the different electronic structure of the metals, with cobalt and nickel having the d-bands more filled with electrons than iron. Results indicate that group 6 elements increase the solubility of nitrogen in molten nickel. Titanium and aluminum were found to increase the dissolution of nitrogen in nickel only slightly, and this is explained by the stable bond between atoms in the metallic solution. N.E.N.

N70-27621# Atomics International, Canoga Park, Calif.
THE SATURATED LIQUID AND VAPOR DENSITY OF CESIUM TO 3000 F, AND THE CRITICAL POINT OF CESIUM
Jack M. Hochman and Charles F. Bonilla (Columbia Univ.) [1969] 9 p refs Presented at the 3rd Symp. on Thermophysical Properties, Lafayette, Ind., 22-25 Mar. 1969 Prepared in cooperation with Columbia Univ.
(Contract AT(30-1)-2660)
(CL-2660-11) Avail: CFSTI

The volumes of the liquid and vapor phases of cesium in a vertical tube were found by passing direct current lengthwise along the tube and locating the liquid level by the IR drop. The test was carried out with three known weights of cesium and to temperatures above 3000 F. Simultaneous solution yielded the densities of the liquid and vapor phases as functions of temperature. The critical temperature of cesium was estimated at 3650 R by a reduced density comparison with mercury, in agreement with an earlier reduced electrical resistivity comparison. The predicted critical pressure is 130.8 atm abs and the density 0.451 g/cc.
Author (NSA)

N70-27626# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECTRAL METHOD OF DETERMINING IRON IN FERROCENE AND ITS DERIVATIVES
E. A. Kuchkarev 8 Oct. 1969 11 p refs Transl. into ENGLISH from Tr. Khim.-Tekhn. Inst. (Moscow), no. 48, 1965 p 51–53
(AD-700343; FTD-MT-24-235-69) Avail: CFSTI CSCL 7/4

A spectral method of determining iron in ferrocene and its derivatives is highlighted by speed, high sensitivity and sufficient accuracy. The method consists of mixing a sample and various organic solvents in a retort, then pouring it in a cooling cup fulgurator using a revolving electrode. A low capacity spark was produced. Spectra were then recorded. Most suitable solvents in this procedure are cyclohexanone and kerosene. Probable error for an individual determination is 3.4%. By using silicon as an element of comparison, the feasibility of simultaneous determinations is shown.
Author (TAB)

N70-27647# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
CHEMI-IONIZATION REACTIONS IN THE GAS PHASE
Arthur Fontijn (AeroChem Res. Labs., Inc.) Jan. 1970 112 p refs
(Contract N00014-67-A-0226-005; Proj. Squid)
(AD-701709; SQUID-TR-AC-7-PU) Avail: CFSTI CSCL 7/4

A comprehensive critical review of the chemi-ionization literature through 1968 is presented. The relationship between chemi-ionization and some other ionization phenomena and chemi-excitation is discussed.
Author (TAB)

N70-27650# Kentucky Univ., Lexington. Dept. of Chemistry.
SALTING EFFECTS IN SEVERAL ALCOHOL-ELECTROLYTE-WATER SYSTEMS
Harold R. Campbell, Aboul K. Shallal, and Henry H. Bauer Dec. 1969 9 p refs
(Contract DAAB07-69-C-0366; Proj. Themis)
(AD-701702; THEMIS-UK-RR-3) Avail: CFSTI CSCL 7/4

Salting effects of sodium sulfate, potassium fluoride, potassium chloride, sodium perchlorate, and perchloric acid on cyclohexanol, 1-pentanol, and 1-butanol were determined by measuring the solubilities of the alcohols in the various electrolyte solutions. Solubilities were determined by color development and spectrophotometry. The relevant Setschenow parameters are reported. There was no apparent correlation between the salting effect and the dipole moment of the alcohol. These data can be used to interpret results of studies of the adsorption of the alcohols at electrode surfaces in the presence of these salts.
Author (TAB)

N70-27687# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
FLASH PHOTOLYSIS OF CARBON DIOXIDE IN THE FAR ULTRAVIOLET [PHOTOLYSE ECLAIRE DE L'ANHYDRIDE CARBONIQUE DANS L'ULTRAVIOLET LOINTAIN]
Francois Barat (Ph.D. Thesis—Paris Univ., 21 May 1969) Jan. 1970 59 p refs In FRENCH; ENGLISH summary
(CEA-R-3865) Avail: CFSTI

The flash photolysis of CO2 (3 torr) in the far ultraviolet, down to the transparency limit of lithium fluoride, produces vibrationally excited CO in its electronic ground state and an electronically excited oxygen atom O(1D). After photolysis, the changes in the concentration of vibrationally de-excited CO in 0 to 200 microsec time range can be followed using absorption spectroscopy. These changes can be explained on the basis of three main competing reactions and their rate constants were determined by analog calculations. The effect of O(1D) scavenging or quenching gases on the oxidation reaction of CO by O(1D) was also examined. A study of the flash photolysis of 01 in the presence of CO in the far ultraviolet eliminated the hypothesis that CO3 is involved in the disappearance of CO after photolysis.
Author (ESRO)

N70-27706# Commissarat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
SEMIANNUAL REPORT OF THE CHEMISTRY DEPARTMENT, JUNE NOVEMBER 1968 [RAPPORT SEMESTRIEL DU DEPARTEMENT DE CHIMIE, JUIN NOVEMBRE 1968]
Jun. 1969 424 p refs In FRENCH
(CEA-N-1148; SAR-6) Avail: AEC Depository Libraries

Developments are reported for studies on chemical analysis of plutonium and uranium, electrochemistry of fused salts and electrocrystallization, treatment of medium and slightly active effluents, reprocessing of uranium, ion exchange in desalination of sea water, aqueous processing of irradiated fuels based on natural uranium, reprocessing of nuclear fuels by dry methods, preparation and study of actinide elements, vitrification of solutions of fission products, and corrosion behavior of alloys in various media.
NSA

N70-27720# Illinois Univ., Urbana.
ELECTROMIGRATION AND CHEMICAL DIFFUSION IN TITANIUM CARBIDE
David Lee Kohlstedt Feb. 1970 241 p ref
(Contract AT(11-1)-1198) (COO-1198-685) Avail: CFSTI

The ionic charge and lattice diffusion of carbon in titanium carbide have been investigated through studies of diffusion under the influences of an applied dc-electric field and of a chemical potential. The electron microprobe was used to measure the diffusion concentration profiles. Electromigration studies of carbon in titanium carbide yielded a positive effective charge which increases from +0.4 at 1825 C to possibly as high as +2.8 at 2480 C. The observed sign and temperature dependence of the effective charge are interpreted as indicating that during the diffusion jump the average carbon-ion charge seen by the electric field is positive and that the hole wind is increasing with respect to the electron wind with increasing temperature. The present work shows that the chemical diffusivity in titanium carbide depends on concentration through the tracer activation energy but not through the pre-exponential factor. A comparison between these single-crystal results and diffusivities reported for chemical diffusion in layer-growth samples demonstrates that the latter represent short-circuit enhanced diffusion.
Author

N70-27725# Toronto Univ. (Ontario). Dept. of Physics.
STIMULATED RAMAN EMISSION AND ABSORPTION SPECTROSCOPY Final Report, 1 Jun. 1965–31 Aug. 1969
Boris P. Stoicheff Nov. 1969 82 p refs
(Contract Nonr-5012(00); ARPA Order-306; Proj. Defender)
(AD-701298; Rept-8) Avail: CFSTI CSCL 7/4

Eight reports (some published) on raman spectroscopy are included. The titles of the reports are as follows: Frequency broadening in liquids by a short light pulse; Angular distribution of surface radiation in stimulated raman scattering; Raman linewidths for stimulated threshold and gain calculations; Intensity and gain measurements on the stimulated raman emission in liquid O2 and N2; A study of the duration and birefringence of self-trapped

filaments in CS2; High-resolution raman spectroscopy of gases with laser excitation; Stimulated raman emission in diamond: spectrum, gain and angular distribution of intensity; and High-speed spectroscopy using the inverse raman effect. TAB

N70-27731# Iowa State Univ. of Science and Technology, Ames.
APPARENT MOLAL VOLUMES OF SOME DILUTE AQUEOUS RARE EARTH SALT SOLUTIONS AT 25 C
Peter Francis Cullen (Ph.D. Thesis) Nov. 1969 110 p refs
(Contract W-7405-eng-82)
(IS-T-342) Avail: CFSTI

The apparent molal volumes of aqueous solutions of La, Nd, Gd, and Lu perchlorates; Pr, Sm, Eu, Gd, Tb, Dy, Ho, Tm, and Lu nitrates; and Eu, Tm, and Lu chlorides were determined from 0.0015 molar to about 0.15 molar at 25 C. The apparent molal volumes were calculated from the specific gravities determined by a magnetically controlled float. When the apparent molal volumes at infinite dilution of a rare earth anion series are plotted against rare earth ionic radius decreases from La to Nd and from Tb to Lu but increases from Nd to Tb with decreasing ionic radius. The variation was found to be independent of the anion. An analysis of the components comprising rare earth ionic radius determined that the trend was present in the term reflecting ion-solvent interactions. This is in agreement with the suggestion that a change in coordination of the rare earth ions occurs in the region from Nd to Tb. Author (NSA)

N70-27746 National Lending Library for Science and Technology, Boston Spa (England).
SEPARATION OF DROPLETE FROM GAS FLOWS
U. Regear 1969 13 p Transl. into ENGLISH from Kemisk Tidskrift (German), v. 81, no. 5, 1969 p 22 25
(NLL-WINDSCALE-Trans-419-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The separation efficiency of droplet separators, designed on the principle of mass inertia, is theoretically calculated. Mathematical models are presented that: (1) calculate the path of an individual droplet, (2) determine the limit droplet, (3) calculate the dimensioning of the droplet separator, and (4) determine the relationship between separation efficiency and flow velocity. Explanations are given for the disagreement in the theoretically calculated relationship and that in actual practice. It is shown that with an increasing flow velocity, the separation efficiency asymptotically approaches 100% but that after exceeding a certain limit value, the efficiency suddenly falls. It is further revealed that the energy required for separation considerably increases with a decreasing diameter of the droplets. It is concluded that: an optimal calculation of a droplet separator requires a knowledge of the data relating to the diameters of the droplets and the droplet spectrum. D.L.G.

N70-27794# Wayne State Univ., Detroit, Mich. Coll. of Liberal Arts.
CONTROLLED POLYMERIZATION OF ADSORBED MONOMERS Technical Progress Report
H. K. Livingston 29 Dec. 1969 12 p refs
(Contract AT(11-1)-1580)
(COO-1580-7) Avail: CFSTI

Adsorption and polymerization investigations are reviewed, including studies of physical adsorption of vapors on solid surfaces, limits in adsorption, polymerization trials at liquid-gas interfaces, and limits in liquid-liquid interactions. E.C.

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N70-26540# Northern Electric Co., Ltd., Lachine, Quebec. Communication Cable Lab.
SURFACE TRANSFER IMPEDANCE MEASUREMENTS, A PRACTICAL AID TO COMMUNICATION CABLE SHIELDING DESIGN
R. J. Oakley Dec. 1969 21 p refs Presented at the 18th Intern. Wire and Cable Symp., Atlantic City
(AD-698720) Avail: CFSTI CSCL 9/1

An expository overview of cable shields and shielding quality is given, up to and including the V.H.F. band, leading to the problem of evaluating different shields whilst still at the design stage. The changes in shielding effectiveness brought about by small design changes can be adequately gauged by the measurement of surface transfer impedance on short sample lengths. The frequency range for the measurements presented in this paper on all types of shield is up to 300 MHz. Some experimental results are presented and discussed, including a section on copolymer bonded aluminum sheaths. Here a study was made of the effects of overlap width and bonding copolymer thickness. Author (TAB)

N70-26542# Environmental Science Services Administration, Boulder, Colo. Space Disturbances Lab.
CONTRIBUTION OF X-RAY AND EXTREME ULTRAVIOLET RADIATION OF SOLAR FLARES TO SUDDEN FREQUENCY DEVIATIONS
R. F. Donnelly Feb. 1969 47 p refs
(ESSA-TR-ERL-95-SDL-7) Avail: SOD $0.50

High time and intensity resolution satellite measurements of X-ray and (EUV) radiation during solar flares are studied to determine the wavelength dependence of the flare radiation responsible for sudden frequency deviations (SFD). SFD measures the flare-induced effects in the E and F1 regions of the ionosphere and are in effect like a broadband (1 to 1030 A) detector for impulsive flare enhancements. The largest contributor to SFD identified to date is the hydrogen recombination continuum emission. The general E- and F1-region effects during SFD are discussed. EUV recombination-continuum and line emission from the more abundant solar constituents, H, He, O, C, and N, appear to be the main cause of SFD. The model commonly used to explain centimeter radio and hard X-ray bursts, wherein a stream of energetic electrons in the flare region produces the centimeter burst via synchrotron emission and the hard X-ray burst via bremsstrahlung emission, is speculated to explain the radiation responsible for SFD via a flash of ionization and near-simultaneous recombination of the solar atmosphere near the sunspots of the active region. Author

N70-26583*# Sylvania Electronic Systems-East, Needham, Mass.
ANTENNA PATTERN SHAPING, SENSING, AND STEERING STUDY Final Report
D. W. Power, S. C. Bigelow, J. D. Killian, P. E. Smith, Jr., and G. D. Whiteside 15 Apr. 1970 212 p refs
(Contract NAS3-11524)
(NASA-CR-72628) Avail: CFSTI CSCL 09E

A conceptual design is presented for a steerable satellite antenna system having four 1-kilowatt RF beams of 2.7 degree half-power beamwidth at a frequency of 12.2 GHz. The antenna pattern sidelobes are more than 25 db down and the losses within the system are less than 1 db. The antenna includes a beam pattern direction sensing system and a steering system to point the pattern in the desired direction within 0.1 degree. The design demonstrates the feasibility of steerable multibeam antenna systems for high-power narrow-beam satellite communication. Author

N70-26616*# Hekimian Labs., Inc., Rockville, Md.
MULTIPATH/MODULATION STUDY: ADAPTIVE TECHNIQUES Final Report, Apr. 1969 Mar. 1970
Mar. 1970 129 p refs
(Contract NAS5-10749)
(NASA-CR-109652) Avail: CFSTI CSCL 17B

Adaptive modulation techniques for combating the expected high level of multipath anticipated in the NASA Tracking and Data Relay Satellite System (TDRS) are studied to develop a modulation design for providing the necessary through-put data rate, RFI protection, and range and range-rate capability. The concept of a burst communication system, and a model of diffuse multipath return are presented. A summary of the advantages of the adaptive burst communication system in the TDRS system is included. Recommendations are: (1) NASA seek VHF allocations for exclusive use, (2) NASA go to the 400 MHz telemetry band, and (3) RFI measurements be taken in the 148 MHZ command band from orbiting s/c in the 100 to 1000 nm purvey of TDRS. F.O.S.

N70-26624*# Magnavox Co., Silver Spring, Md. Government and Industrial Div.

MULTIPATH/MODULATION STUDY FOR THE TRACKING AND DATA RELAY SATELLITE SYSTEM Final Report, 14 Apr. 1969 - 12 Jan. 1970

J. N. Birch 12 Jan. 1970 453 p refs

(Contract NAS5-10744)

(NASA-CR-109648) Avail: CFSTI CSCL 17B

A system was evolved as a result of many tradeoff analyses which will provide the users of Tracking and Data Relay Satellite Systems with the following capabilities: immunity to multipath, multiple access through a wideband satellite in the presence of many other users, interference rejection capability, accurate range and range rate tracking by one or more ground stations, simultaneous transfer of data and ranging information, and simultaneous contact between a ground station and many users. In addition to these gross capabilities, the approach provides for rapid synchronization between a user and ground station, and provides for all the required data rates and voice requirements. The system has built-in margins to insure successful operation. Author

N70-26638# RAND Corp., Santa Monica, Calif. Engineering Sciences Dept.

BROADCAST OPPORTUNITIES WITH SATELLITES AND CATV, AND THEIR CONTROL IN THE PUBLIC INTEREST

John L. Hult Mar. 1970 11 p refs Presented at 7th Space Congr., Technol.—Today and Tomorrow, Cocoa Beach, Fla., 22 - 24 Apr. 1970

(P-4333) Avail: CFSTI

The opportunities for providing new TV broadcast services and a variety of social benefits from broadcast using satellites and CATV are explored. The relative costs of the various alternatives are outlined, and new regulatory and operational policies are suggested. The material is intended to ease international concern about the control of satellite broadcasting in order to gain support for permissive frequency allocations. Also, an attempt is made to stimulate domestic vested interests by outlining a wealth of novel opportunities available under the suggested new policies. Author

N70-26680# Akademiya Nauk URSR, Kiev.

PRINCIPLES OF PHONEME DISCRIMINATION OF WORDS ACCORDING TO PROBABILITIES OF FITTING SAMPLED SPEECH FLOW TO GIVEN PHONEME STANDARDS

R. Ya. Gumetskiy, M. F. Derkach, L. N. Mishin, and M. M. Overchenko *In its* Appl. Acoustics and Vibration Technol. 1968 p 29 - 35 refs In RUSSIAN (See N70-26676 13-34)

Avail: CFSTI

The application of statistical analysis to automatic phoneme discrimination of rapid speech is studied by estimating the probabilities of fitting sampled speech flow to given phoneme standards. When the aposterior probabilities of phoneme discrimination are present in the speech flow, not only are the average values computed, but also the standard deviation of phoneme standards. Arguments are presented for increasing the reliability of automatic speech discrimination when using the described method of phoneme identification of speech flow. Transl. by H.W.

N70-26727# Naval Postgraduate School, Monterey, Calif.

SYNTHESIS OF A BASIC RANGE CHANNEL FOR IMPLEMENTATION OF A COMPLETE MTI BY RANGE GATED FILTERING

Eric Lee Washam (M.S. Thesis) Jun. 1969 51 p refs

(AD-700710) Avail: CFSTI CSCL 17/9

A range-gated channel was constructed for use with various Doppler filters in building the basic element of a radar Moving-Target-Indicator (MTI) by Range-Gated-Filtering (RGF). Improvement over existing systems was accomplished by circuit simplification and solid-state design incorporating MOS devices in sampling circuits and d-c coupled amplifiers. Performance of the channel, using an R-C high-pass filter as the simplest Doppler filter, was compared to that of the delay-line canceler MTI of the AN/UPS-1 air-search radar. Author (TAB)

N70-26744# Syracuse Univ. Research Corp., N.Y.

MEASUREMENTS OF METEOROLOGICAL PARAMETERS AND RADIO REFRACTIVITY IN THE CARIBBEAN

L. G. Rowlandson, R. J. Aldrich, and J. R. Herlihy Bedford, Mass. ESD Nov. 1969 269 p refs

(Contract F19628-69-C-0208)

(AD-701023; ESD-TR-69-374) Avail: CFSTI CSCL 17/2

A series of meteorological measurements was made in the northern part of the Caribbean Sea during the spring of 1969, to characterize the Trade Wind Inversion and its effect on radio wave propagation. Among the measurements made were data collected from the sensors on the airborne platform of the USAF C-131 Convair (37812), which was provided for use on this contract. The report is a compendium of some of the airborne data, namely of the processed digital records of air temperature, air pressure, refractivity, water vapor pressure and potential temperature. These values are presumed as absolute quantities which have been corrected to compensate for the effect of aircraft motion and thermal expansion of the microwave refractometer sensing cavity. Author (TAB)

N70-26757# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE INFLUENCE OF FINITE GROUND CONDUCTIVITY ON THE DIRECTIVITY PATTERNS OF VERTICAL ANTENNAS

G. N. Krylov 29 Jul. 1969 10 p refs Transl. into ENGLISH from Probl. Difraktsii i Rasprostraneniya Voln (USSR), no. 6, 1966 p 139 - 143

(AD-700583; FTD-HT-23-118-68) Avail: CFSTI CSCL 20/14

The author shows that the amplitude of a radio wave propagating at a finite angle to the surface of the earth, taking into account the earths conductivity and the directivity of the antenna, can be calculated in terms of the components of the Hertz vector and of the electromagnetic field of a vertical antenna over an ideal earth, by introducing the concept of surface impedance and the attenuation factor. He then presents directivity patterns for a dipole placed on the surface, as functions of the parameters of the earth that are encountered in practice. An analysis of the numerical data shows that the influence of the earths finite conductivity can cause an appreciable attenuation of a wave reflected from the ionosphere, especially in the case of poorly conducting ground. TAB

N70-26782# Naval Postgraduate School, Monterey, Calif.

A SOLID STATE PULSE MODULATED RAPIOSONDE

Ara Sagerian (M.S. Thesis) Jun. 1969 109 p refs

(AD-700699) Avail: CFSTI CSCL 4/2

The thesis is concerned with the design and construction of a radiosonde used in solid state devices and state-of-the-art techniques. The radiosonde is designed with the idea of obtaining data at a ground station in digital form and transmitting this data direct to Weather Central via high speed data links. Pulse modulation is used to transmit the data from the radiosonde. The multiplexer (time multiplexing is utilized) is designed using MOS

micro technology and a breadboarded simulation is accomplished using discrete MOS integrated circuits. A computer simulation of the actual multiplexer design is performed. The modulator and transmitter are of complete solid state design. Extensive testing of the overall system indicated satisfactory results and show a substantial improvement over the present radiosonde. Modification of ground receiving systems to facilitate proper reception of information from the radiosonde is also discussed. Author (TAB)

N70-26803# Army Engineer Topographic Labs., Fort Belvoir, Va.
USE OF SIDE-LOOKING AIRBORNE RADAR (SLAR) IMAGERY FOR ENGINEERING SOILS STUDIES
David J. Barr Sep. 1969 133 p refs
(AD-701902; USAETL-46-TR) Avail: CFSTI CSCL 17/9

The report is concerned with the development and evaluation of techniques of utilizing Side-Looking Airborne Radar (SLAR) imagery for engineering soils studies. The primary objective was the development of a systematic SLAR image interpretation technique. Secondary objectives included an evaluation of methods for quantification of SLAR image textures and radar shadows. SLAR images from a variety of physiographic regions within the United States were evaluated. Systems operating at several wavelengths were represented in the study. Field checking was performed for several of the study sites. Author (TAB)

N70-26842# Naval Research Lab., Washington, D.C.
PROGRAM TO COMPUTE ARRAY RESPONSE SURFACES
James Jenkins Sep. 1969 18 p refs
(AD-700655; NRL-MR-2077) Avail: CFSTI CSCL 17/1

BEAMPLOT is a FORTRAN program designed to simulate the response of a general volume array to an incoming plane wave. The program is normally used with a three-dimensional plot routine to display output values as a response surface. The program is useful in studying the dependence of the response of an array-beamformer combination on signal frequency, beamforming delays and hydrophone weighting. Author (TAB)

N70-26868# Lincoln Lab., Mass. Inst. of Tech., Lexington.
VARIABLE-COVERAGE COMMUNICATIONS ANTENNA FOR LES-7
Andre R. Dion 17 Oct. 1969 31 p refs
(Contract AF 19(628)-5167)
(AD-700760; TR-471; ESD-TR-69-319) Avail: CFSTI CSCL 22/2

An experimental model of the variable-coverage communications antenna system for the LES-7 spacecraft is described. Consisting of a waveguide lens, a 19-horn feed cluster, and a combiner switch, the system will permit selection of the antenna pattern that best matches a desired coverage on earth. The coverages realizable are of many sizes and shapes, and extend from that of a 3 deg pencil beam to a full hemisphere. A computer study of this antenna system gave results in good agreement with measurement. The salient features of this study are also described. Author (TAB)

N70-26871# Syracuse Univ., N.Y. Dept. of Electrical Engineering.
COMPUTATION OF RADIATION AND SCATTERING FROM LOADED BODIES OF REVOLUTION
Roger F. Harrington and Joseph R. Mautz Jan. 1970 56 p refs
(Contract F19628-68-C-0180)
(AD-701744; SR-4; AFCRL-70-0046) Avail: CFSTI CSCL 20/14

The problem of radiation and scattering from loaded conducting bodies of revolution is considered. A numerical solution is obtained from the integro-differential equations by the method of moments. Computer programs are given for plane-wave scattering, axial incidence, and for aperture radiation, rotationally symmetric excitation. Computations for some representative loaded antennas and loaded scatterers are graphed to illustrate the use of the programs. Author (TAB)

N70-26910# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ERROR-LOCATING CODES
V. V. Kiselev-Gusev 11 Sep. 1969 10 p refs Transl. into ENGLISH from Materialy Yubilein. Nauchn.-Tekhn. Konf. (USSR), no. 4, 1967 p 217–220
(AD-700602; FTD-HT-23-360-69) Avail: CFSTI CSCL 9/4

It is shown that a code which determines the position of an individual subunit containing up to e errors should satisfy the following conditions: (1) a syndrome calculated in the presence of e or fewer errors within any individual subunit should be different from a zero syndrome; (2) a syndrome calculated in the presence of e or fewer errors within an individual subunit should be different from the syndrome, calculated in the presence of another combination of e or less errors within any other subunit. Author (TAB)

N70-26954# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SPECTRAL ANALYSIS OF THE CONVOLUTION AND FILTERING OF NONSTATIONARY STOCHASTIC PROCESSES Final Report
William D. Mark Jan. 1969 114 p refs
(Contract N00024-68-C-1154)
(AD-701712; BBN-1764) Avail: CFSTI CSCL 9/4

A unified theory is presented that deals with the spectral description, the convolution, and the filtering of nonstationary stochastic processes. Two time-dependent spectrum definitions, the physical spectrum and the instantaneous spectrum, are discussed in detail. Author (TAB)

N70-27001# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A METHOD OF COMPENSATING FOR THE AMPLITUDE FLUCTUATIONS OF A SIGNAL REFLECTED FROM AN AIRCRAFT
I. V. Baryshev 3 Oct. 1969 11 p refs Transl. into ENGLISH from the Russian
(AD-700803; FTD-HT-23-210-69) Avail: CFSTI CSCL 17/9

A method for reducing the effect of signal-intensity fluctuations on the accuracy of measuring angular coordinates in beam scanning is proposed. The fluctuations are mainly due to time variation in the interference pattern of electromagnetic oscillations reflected from different parts of the aircraft. The angular coordinates are determined using two receiving channels. All compensation operations are performed in the low-frequency part of the receiver. Logarithmic amplifiers with identical logarithmic amplitude characteristics are used. TAB

N70-27032*# Ohio State Univ., Columbus. ElectroScience Lab.
A MOBILE FACILITY FOR MEASURING THE BACKSCATTERING AND BRIGHTNESS TEMPERATURE OF TERRAIN AT MICROWAVE FREQUENCIES
T. L. Oliver (M.S. Thesis) 4 Oct. 1968 90 p refs
(Contract NSR-36-008-027)
(NASA-CR-100644; Rept-1903-6) Avail: CFSTI CSCL 17/1

The design and construction of a truck-mounted facility for measuring the backscattering and brightness temperature of terrain at microwave frequencies are discussed, including procedures for calibration and data reduction. Descriptions of the linearly polarized, c-w doppler radar systems, operated at 1.8, 10, 15 and 35 GHz, and the radiometer systems (10 and 35 GHZ) are also presented. Author

N70-27036# Air Force Cambridge Research Labs., Bedford, Mass. Microwave Physics Lab.
MULTIPLE-STATION DOPPLER SYSTEMS
F. Sheppard Holt Nov. 1969 21 p refs
(AD-701397; AFCRL-PSRP-399; AFCRL-69-0517) Avail: CFSTI CSCL 17/9

One-station, two-station, and three-station, active and passive, non-directional, continuous wave doppler systems are analyzed for targets moving along straight line paths with uniform speed. Accurate frequency information as a function of time is assumed. For fundamental reasons the one- and two-station systems are incapable of uniquely fixing the target path although they can determine target speed and minimum range. The three-station system overdetermines the target motion, but in practical applications the redundant information can be used to resolve multiple target ambiguities. Author (TAB)

N70-27066# Hawaii Univ., Honolulu. Information Sciences Program.
ESTIMATION OF RANDOM FILTER CHARACTERISTICS Interim Report
N. Thomas Gaarder Feb. 1970 24 p refs Presented at the 2d Hawaii Intern. Conf. on System Sci., Honolulu, Hawaii, 22-24 Jan. 1969
(Grant AF-AFOSR-1251-67)
(AD-701791; AFOSR-70-0466TR) Avail: CFSTI CSCL 9/4

The report considers the estimation of homogeneous random filter characteristics using simple estimators. First a linear operation on the sum of the random filter output and independent white noise is used to estimate a linear operation on the instantaneous transfer function of the filter. Choosing the transmitted signal x(t) and linear weighting g(t) to minimize the mean square error is shown to be equivalent to finding the cross ambiguity function that approximates a known function best in a weighted least-squares sense. A lower bound on the minimum error variance is also found. The results unify and extend the results of Sussman and DeLong and Hofstetter, as well as providing a readily interpretable form of the as yet unsolved minimization problem. The estimation of generalized second moment of the transfer function is also considered. A simple estimator structure is used and the resultant minimization problem is similar to the first problem. Author (TAB)

N70-27195# Naval Research Lab., Washington, D.C.
A REVIEW OF WIDEBAND AMBIGUITY FUNCTIONS Interim Report
David A. Swick 30 Dec. 1969 15 p refs
(AD-700657; NRL-6994) Avail: CFSTI CSCL 17/9

The wideband ambiguity function considers the actual time compression or expansion of the Doppler effect, rather than the fequency-shift approximation of narrowband function. The wideband ambiguity function has been derived and its properties reviewed, including comparisons with those of the narrowband function. The significance of the difference between the two functions can be shown to depend on the product of signal duration, signal bandwidth, and target velocity. Author (TAB)

N70-27246# Kabel-Und Metallwerke Gutehoffnungshuette A.G., Hannover (West Germany).
ELECTRICALLY WELDED THIN ALUMINUM ENVELOPES AND THEIR USE IN COMMUNICATIONS CABLE DESIGNS
Ernst Schaffler, Dimitri R. Stein, Gerhard Wanser, and Gerhard Ziemek 1969 12 p refs Presented at the 18th Intern. Wire and Cable Symp., Atlantic City, N.J., 3-5 Dec. 1969
(AD-698607) Avail: CFSTI CSCL 17/2

The paper deals with the kabelmetal Weldfoil process, a process for welding aluminum strip of a thickness less than 0.25 mm (0.010 in.) on cable core diameters up to 75 mm (3 in.). Welded aluminium envelopes made by this process can be used as vapour impervious shields for many types of telecommunication cables. On a UNIWEMA welding machine a strip is formed around the core so that the side portions are radially extended. By trimming both side portions in one cut they are aligned and give a tab of requisite height. Across the oxide-free edges of the tab a crown is welded along the length of the envelope so formed. The tab is then folded down. A copolymer layer and a conventional polyethylene jacket are extruded over the tab-welded envelope. Such a sheath is completely vapour impervious and has the required mechanical characteristics. The full circumferential conductivity provided by the welded envelope imparts excellent shielding properties. Test data are given and examples of several cable designs are discussed. Author (TAB)

N70-27271# Joint Publications Research Service, Washington, D.C.
SOYUZ SPACESHIPS CONVERSE VIA SATELLITE
A. Petrov et al 14 May 1970 26 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 2, 1970 p 25-26
(JPRS-50519) Avail: CFSTI

Two variants of radio communication between Soyuz spacecraft and ground control stations are discussed. The first variant employs communications stations on ships at sea, which relay information via communication satellites to flight control center. The second variant uses a communication satellite as a direct relay between the spacecraft and flight control center. The variants are used for UHF and VHF ranges when the spacecraft is not in the line of sight of the ground control station. R.B.

N70-27376*# Techtran Corp., Glen Burnie, Md.
A RANDOM ELECTROMAGNETIC FIELD AND ITS DISTRIBUTION UPON REFLECTION OF WAVES FROM AN EXTENDED ROUGH SURFACE [SLUCHAYNOYE ELEKTROMAGNITNOYE POLE I YEGO MOMENTY RASPREDELENIYA PRI OTRAZHENII VOLN OT PROTYAZHENNOY SHEROKHOVATOY POVERKHNOSTI]
A. P. Zhukovskiy Washington NASA May 1970 18 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gorkiy), v. 12, no. 10, 1969 p 1482-1493
(Contract NASw-2037)
(NASA-TT-F-12898) Avail: CFSTI CSCL 20N

The scattering of an elliptically polarized wave striking an extended rough surface of finite conductivity is analyzed. It is shown that with all nonzero angles of incidence, the distribution of random inclinations of the profile and random coefficients of reflection must be considered. Author

N70-27385*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
DETECTION OF RANGE RATE BIAS IN THE TWO-WAY DOPPLER MEASUREMENTS OF EXPLORER 34
C. W. Murray, Jr. Apr. 1970 48 p refs Submitted for publication
(NASA-TM-X-63908; X-551-70-122) Avail: CFSTI CSCL 17B

A bias of a few centimeters per second in the two-way Doppler range rate measurements of Explorer 34 was detected through orbit determination techniques. Results of a previous theoretical analysis indicate that a 3 centimeter per second bias can be attributed to the effect of satellite spin on the measurements. The previous analysis is verified and it is shown that by correcting the range rate data for this bias, the total weighted root mean square of the residuals after fit by the equations of motion is reduced. A discussion of maximum likelihood estimation in the orbit determination process and optimum statistical properties of the estimator is also included. Author

N70-27410# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

A 100 MHz CODING SCALER [ECHELLE DE CODAGE A 100 MHz]

Vsevolod Goursky and Edith de Khovrine Mar. 1970 25 p refs In FRENCH; ENGLISH summary

(CEA-R-3971) Avail: CFSTI

A description is given of a 12 bit coding scaler working at a clock frequency of 100 MHz, for use with a Wilkinson amplitude-to-time converter. In the design, special attention was given to: (a) the phasing circuit to trigger the start-pulse by means of the first flip-flops of the binary scaler which acts as fast discriminator so reducing costs and increasing reliability; (b) a straightforward circuit in order to eliminate cyclic defects in differential linearity due to transitions of the flip-flops. Author (ESRO)

N70-27429 National Lending Library for Science and Technology, Boston Spa (England).

THE LAYING OF COMMUNICATION CABLES WITH PLASTICS SHEATHS

K. K. Nikol'Skii et al [1969] 14 p Transl. into ENGLISH from Tekhn. Syazi Za Rubezhom (USSR), 1969 p 31-34, 43-45, 67-69, 75-76

(NLL-Trans-2633(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 photocopy coupons

Methods for hot assembling of plastic cable sheaths and plastic core insulation are defined. Repair methods for a PVC cable sheath include use of a plastic strip, with or without a collar; PVC tape impregnated in epoxy resin; or tape and adhesive. The assembly of a cable using an epoxy compound, adaptor couplings based on epoxy and a lead cable joint, or metal and plastics adaptor couplings is described. S.S.

N70-27440*# General Electric Co., Philadelphia, Pa. Space Systems Organization.

MULTIKILOWATT TRANSMITTER STUDY FOR SPACE COMMUNICATIONS SATELLITES. VOLUME 1: SUMMARY REPORT, PHASE 1

10 Jun. 1968 27 p

(Contract NAS8-21886)

(NASA-CR-109651; DOC-68D4268) Avail: CFSTI CSCL 17B

This summary report discusses a study performed on high-power transmitters with potential applicability to satellite TV broadcasting. All logical transmitter types are analyzed parametrically in terms of efficiency, weight, and cost for a 1970 state-of-the-art. Results are combined with data on related subsystems to provide overall transponder system parametric data. Three representative transmitter configurations are analyzed in a design study of circuitry, thermal control mechanisms, and mechanical configurations. Key technology problem areas are then defined on the basis of the study outputs. The major recommendation is continuation of the study in the most cirtical areas as a preliminary step to a transmitter development program. Author

N70-27491# Koln Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.

A COMPUTER PROGRAM FOR EVALUATING RADIO SIGNAL PROPAGATION FROM ARTIFICIAL EARTH SATELLITES [EIN RECHENPROGRAMM ZUR BESTIMMUNG DER AUSBREITUNG VON RADIOSIGNALEN KUENSTLICHER ERDSATELLITEN]

Guenter Herrmann Jan. 1970 39 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.

(BMBW-FB-W-70-04) Avail: CFSTI

A computer program for tracing the rays of radio signals from an artificial satellite to a terrestrial observer, taking into account ionospheric double refraction, is described. The ionosphere is represented by two homogeneous stratified layers with Chapman profiles and the geomagnetic field is assumed to be that of a dipole. Author (ESRO)

N70-27526# AEG-Telefunken, Ulm (West Germany).

ANALOG TELEMETRY MODULES. FURTHER DEVELOPMENT OF ASSEMBLIES FOR THE ECONOMICAL PRODUCTION OF FUNCTIONAL UNITS FOR SPACE APPLICATIONS [ANALOGTELEMETRIE: VERVOLLSTAENDIGUNG DES BAUSTEINPROGRAMMS FUER RATIONELL ZU FERTIGENDE FUNKTIONSEINHEITEN FUER DEN RAUMFLUG]

A. Marmann and M. Waibl Feb. 1970 72 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.

(BMBW-FB-W-70-08) Avail: CFSTI

After a brief discussion of the possibilities of making a subcarrier oscillator, the development and construction of subcarrier oscillators for IRIG-channels 17, 18, 19 and 20 (52.5 kHz-124 kHz) are described. A previous circuit configuration was modified and assembled in a block containing three thick-film units and several other components. After a thorough electrical examination the subcarrier oscillators were subjected to mechanical tests which are of fundamental interest for space applications. Author (ESRO)

N70-27627# European Space Vehicle Launcher Development Organization, Paris (France).

TV SATELLITE BROADCASTING [SATELLITEN-RUNDFUNK]

S. Hieber Mar. 1970 28 p refs In GERMAN

(ELDO-PUBL-26) Avail: CFSTI

This report outlines significant features of possible satellite broadcasting and program distribution services according to the recommendations of the International Radio Consultative Committee (CCIR). Direct and indirect television services to individuals and communities are considered. The technical factors underlying reception quality such as modulation techniques, receiver sensitivity, antenna types, frequencies, satellite orbits, coverage areas and satellite power are discussed. Examples of typical system power budgets illustrate the possibility of several mission concepts. ESRO

N70-27648# Royal Aircraft Establishment, Farnborough (England).

THE OPERATION OF MOLNIYA COMMUNICATIONS SATELLITES

R. R. Allan Nov. 1969 23 p refs

(RAE-TR-69266) Copyright. Avail: CFSTI

Up to October 1969 the USSR had launched a total of twelve Molniya communications satellites, together with three objects in similar orbits designated as Cosmos satellites. These are in highly eccentric 12-hour orbits at an inclination of about 65 deg with apogees in the Northern Hemisphere near the northern apex. Such satellites are subject to resonance effects due to the longitude-dependence of the geopotential in much the same way as synchronous satellites, and there is a stable configuration in which the apogees occur at particular longitudes relative to the Earth. Earlier work showed that Molniya 1D (1966-92A) was stabilized. This report examines the four satellites launched in 1967, the four launched in 1968 and the first two launched in 1969. It is concluded that the USSR would have established a viable system of communications satellites giving nearly complete 24-hour coverage of the Soviet Union by the end of 1968 with the trio Molniya 1H, 1J and 1K. Author (ESRO)

N70-27662*# Techtran Corp., Glen Burnie, Md.

SEQUENTIAL DECODING FOR A BINARY CHANNEL WITH DROPOUTS AND INSERTIONS [POSLEDOVATELBNOE

DEKODIROVANIE DLYA DVOICHNOGO KANALA S VYPADENIYAMI I VSTAVKAMI]
K. Sh. Zigangirov Washington NASA Apr. 1970 14 p refs Transl. into ENGLISH from Probl. Peredachi Inform. (Moscow), v. 5, no. 2, 1969 p 23-30
(Contract NASw-2037)
(NASA-TT-F-12991) Avail: CFSTI CSCL 09D

A method of sequential decoding in a binary channel with independent dropouts and insertions of symbols is analyzed. The coding is convoluted and estimates of the parameters of the channel are produced. Author

N70-27680# Naval Research Lab., Washington, D.C.
A GUIDE TO BASIC PULSE-RADAR MAXIMUM-RANGE CALCULATION. PART 1: EQUATIONS, DEFINITIONS, AND AIDS TO CALCULATION Interim Report
Lamont V. Blake 23 Dec. 1969 158 p refs
(AD-701321; NRL-6930) Avail: CFSTI CSCL 17/9

The basic equation for pulse-radar maximum-range calculation is presented in a form convenient for numerical computation. Charts, graphs, tables, and auxiliary equations are presented for evaluation of the various factors in the range equation. Included are graphs for the required signal-to-noise ratio as a function of probability of detection, false-alarm probability, and number of pulses integrated, for both nonfluctuating and fluctuating (Swerling Cases 1 and 3) echoes. Also treated are the effects of receiver bandwidth, antenna and receiver noise, sea-reflection interference, refraction and absorption by the atmosphere, and various system losses. Standard definitions of range-equation quantities are given. The effects of jamming and clutter echoes are treated briefly, as are also cumulative probability of detection and accuracy of radar range prediction. A systematic procedure for range calculation, employing a work sheet, is presented. Author (TAB)

N70-27696# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
NON-LINEAR PARTICLE TRAJECTORIES IN A WHISTLER MODE WAVE PACKET
M. Abdalla Feb. 1970 31 p refs
Avail: CFSTI

Particle trajectories for the case of a whistler wave packet propagating in the direction of the ambient magnetic fields are computed. The computed trajectories enable the study of the distortion of a loss cone by such a wave. Currents are obtained and comparison with linear theory, show that non-linear effects reduce the current. It is found that the time behavior of the fields is such as to make the packet grow at the front and decay at the rear. Author (ESRO)

N70-27630# Institute for Telecommunication Sciences, Boulder, Colo.
ANALYSIS OF A PROPAGATION CHANNEL FOR A DIGITAL COMMUNICATION SYSTEM, PHASE D, PART 1 Final Report, 1 Aug. 1969 – 1 Jan. 1970
J. R. Juroshek Dec. 1969 50 p refs
(Contract F04701-68-F-0072)
(AD-701056; ESSA-TM-ERLTM-ITS-218-P1-1; SAMSO-TR-70-50) Avail: CFSTI CSCL 17/2

A hypothetical aircraft-to-ground communication channel is examined for frequencies in the 2-30 MHz portion of the MF-HF band, and the 200-400 MHz portion of the VHF-UHF band. The channel is characterized in terms of its correlation function and scatter function. Particular attention is given to the effects of multipath spread and frequency spread on the performance of a noncoherent, frequency-shift-keyed, matched filter receiver. The effect of aircraft motion on channel multipath spread is also examined. Author (TAB)

N70-27699# Edgerton, Germeshausen and Grier, Inc., Bedford, Mass. Eastern Science and Technology Div.
AIRBORNE SATELLITE COMMUNICATIONS DURING AURORAL STUDIES Final Report
Carl F. Sundstrom and Manual M. Garcia Sep. 1969 19 p refs
(EGG-1183-524; B-4101) Avail: CFSTI

A series of auroral studies flights flown during March 1968 included communications equipment experiments designed to test the efficacy of incorporation of a satellite link in maintaining two-way communications between aircraft flying at high altitude at conjugate auroral points located in opposite hemispheres. The ground test, flight check, and actual auroral missions communications showed that marked improvement in coordination between the aircraft and between the experimental systems aboard the separate aircraft was possible using the ATS-1 satellite. Author (NSA)

N70-27753# Hamburg Univ. (West Germany).
CORRELATION OF FIELD STRENGTH FADING AND MICROPRESSURE VARIATIONS [KORRELATION VON FELDSTAERKEFADING UND MIKRODRUCKSCHWANKUNGEN]
G. Fengler *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 1-6 refs In GERMAN; ENGLISH summary (See N70-27752 13-13)
Avail: CFSTI

The wave-like variations of the VHF-field strength observed on transhorizon links correlate over several minutes with the periodic micropressure variations caused by internal gravity waves propagating in the lower troposphere. The paper deals with statistical evaluation of the occurrence of coincident periodic micropressure and field strength variations due to the weather situation and the vertical stratification of the troposphere. Individual cases demonstrate the results obtained by statistical methods. Author (ESRO)

N70-27765# Bundesanstalt fuer Flugsicherung, Frankfurt am Main (West Germany).
REDUCTION OF PROPAGATION PERTURBATIONS OF OMNIDIRECTIONAL RADIO RANGES BY REVERSAL OF TYPES OF MODULATION [REDUZIERUNG DER AUSBREITUNGSSTOERUNGEN VON DREHFUNKFEUERANLAGEN DURCH UMSTELLUNG DER MODULATIONSARTEN]
K. Nattrodt *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 17-20 refs In GERMAN (See N70-27752 13-13)
Avail: CFSTI

A description is given of a Doppler VHF omnirange navigation system, situated in a thick forest, and the propagation problems of this system, which, especially in wintertime, lead to false course information. A solution was found by using a reversal of the amplitude and frequency modulation for the reference phases, and a circular antenna array. ESRO

N70-27759# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Ionosphaerenphysik.
VLF PROPAGATION OVER GREAT DISTANCES AS A MEANS OF INVESTIGATING THE LOWER IONOSPHERE [LAENGSTWELLENAUSBREITUNG UEBER GROSSE ENTFERNUNGEN ALS MITTEL ZUR ERFORSCHUNG DER TIEFSTEN IONOSPHAERE]
K. Rinnert *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 45-52 refs In GERMAN (See N70-27752 13-13)
Avail: CFSTI

Propagation conditions of very low frequencies were calculated with mode theory, the ionospheric wave guide limitation being taken as a horizontally layered, isotropic plasma. Depending on the height at which the electron concentration increases, a character-

istic change of the propagation parameters takes place. From the layered daytime electron density profile at middle latitudes, conclusions were drawn about the night-time profile and the way in which seasonal changes of the recorded diurnal variations can be explained from phase relationship and field strength along several propagation paths by changed N(h)-distributions. Author (ESRO)

N70-27760# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (East Germany).

OBSERVATIONS OF ATMOSPHERICS WITH THE ATMOSPHERICS ANALYZER OF THE HEINRICH-HERTZ-INSTITUTES [BEOBACHTUNGEN DER ATMOSPHERICS-AKTIVITAET MIT DEM ATMOSPHERICS-ANALYSATOR DES HEINRICH-HERTZ-INSTITUTS]

J. Frisius and G. Heydt *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 53–62 refs In GERMAN; ENGLISH summary (See N70-27752 13-13)
Avail: CFSTI

The atmospherics analyzer of the Heinrich-Hertz-Institute gives data on the statistical parameters of VLF radio noise as functions of the azimuth. The following data from continuous observations are given: distribution of atmospherics and sources with respect to both direction of arrival and observed values of the group delay-time difference and the influence of daytime and season; and correlations between different statistical parameters. Improvements give (1) numerical determination of the distribution of spectral parameters in a narrow direction sector which can be selected by the observer, and the distribution of atmospherics with respect to the direction of arrival; (2) analog presentation of statistical parameters characterizing the activity of a narrow direction sector, and the automatic record of the distribution of the activity with respect to the direction of arrival. Author (ESRO)

N70-27761# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (East Germany).

STATISTICAL MEASUREMENTS OF THE GROUP DELAY TIME DIFFERENCES OF ATMOSPHERICS BELOW 10 kHz [STATISTISCHE MESSUNGEN DER GRUPPENLAUFZEITDIFFERENZ VON ATMOSPHERICS UNTERHALB 10 KHZ]

G. Heydt and W. Harth *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 63–72 refs In GERMAN; ENGLISH summary Prepared jointly with Max-Planck-Inst. fuer Radioastron. (See N70-27752 13-13)
Avail: CFSTI

An atmospherics-analyser was used to obtain delay-time differences of spectral groups of frequencies of the VLF band of atmospherics and their variation over day and night of thunderstorms. The dependance of the group delay-time difference on distance was determined from ESSA 5 cloud pictures. In some cases, a splitting was accompanied by a splitting of the angle of incidence. The bearings of pulses coming from one long-lasting thunderstorm shifted from 3 deg to 7.5 deg with sunrise and sunset. The splitting of the bearing into two and three components by more than 10 deg was found for far-away sources. Sudden anomalies of both the group delay-time difference, as measured at 7 kHz with Delta f = 2 kHz and the amplitude ratio at 6 and 8 kHz during strong flares can be used as new indicators for SIDs. Author (ESRO)

N70-27765# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Ionosphaerenphysik.

STATISTICAL EVALUATION OF AURORAL BACKSCATTER OBSERVATIONS AND A COMPARISON WITH PLASMA INSTABILITY THEORY [STATISTISCHE AUSWERTUNG VON POLARLICHTRUECKSTREUBEOBACHTUNGEN UND DER VERGLEICH MIT DER THEORIE DER PLASMA-INSTABILITAET]

P. Czechowsky *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 97–103 refs In GERMAN (See N70-27752 13-13)
Avail: CFSTI

Auroral backscatter measurements in the ultra-short wave range were evaluated. The diurnal variations of the backscatter echo, depending on geomagnetic latitude and activity were analyzed, and the results were compared with those from stations in different geographic latitudes. The principles of the two-stream plasma-instability theory are explained and examples show that it can account for some of the observations. Author (ESRO)

N70-27772# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany). Forschungsinst.

POSITIVE PHASES AND PERTURBATIONS OF IONOSPHERIC PROPAGATION COMPARED WITH SOLAR-TERRESTRIAL EVENTS [POSITIVE PHASEN UND STOERUNGEN DER IONOSPHAERISCHEN WELLENAUSBREITUNG IM VERGLEICH ZUM SOLAR-TERRESTRISCHEN GESCHEHEN]

B. Beckmann *In its* Kleinheubacher Rept., Vol. 13 1969 p 141–154 refs In GERMAN (See N70-27752 13-13)
Avail: CFSTI

An investigation is made of the role solar and geomagnetic activity play in ionospheric propagation. ESRO

N70-27783# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (East Germany).

LONG-TERM REGISTRATION OF WHISTLER ACTIVITY USING AN AUTOCORRELATION METHOD [DAUER-REGISTRIERUNG DER WHISTLER-AKTIVITAET MIT HILFE EINES AUTOKORRELATIONS-VERFAHRENS]

G. Heydt and J. Frisius *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 213–221 refs In GERMAN; ENGLISH summary (See N70-27752 13-13)
Avail: CFSTI

A new technique is described for the continuous, quantitative observation of whistlers which are identified by an electronic autocorrelation method using a fixed delay-time. The signals are analyzed by means of an electronic analog computation method in such a way that the frequency and field strength variation of every whistler is indicated by an analog output voltage. The activity observations over a period of four weeks is discussed. Author (ESRO)

N70-27784# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Inst. fuer Meteorologie und Geophysik.

RELATIONS BETWEEN SOLAR ACTIVITY AND OBSERVATIONS OF THE DAWN CHORUS [ZUSAMMENHAENGE ZWISCHEN SOLARER AKTIVITAET UND BEOBACHTUNGEN DES DAWN CHORUS]

G. Mattern *In* Fernmeldetech. Zentralamt, Kleinheubacher Rept., Vol. 13 1969 p 223–226 refs In GERMAN (See N70-27752 13-13)
Avail: CFSTI

A five year series of observations of the dawn chorus was correlated with solar activity and relation was found between the mean geomagnetic activity and the frequency of the dawn chorus. The observations showed that during years with low solar activity the dawn chorus may still be observed at stations with sensitive equipment. Author (ESRO)

N70-27796# RAND Corp., Santa Monica, Calif.

SPECTRUM FOR AREA COVERAGE FROM SATELLITE RELAYS TO SMALL TERMINALS

John L. Hult Mar. 1970 9 p ref Presented at AIAA 3d Commun. Satellite Systems Conf., Los Angeles, 6-8 Apr. 1970 Submitted for publication
(P-4301) Avail: CFSTI

Small terminal area coverage for mobile and broadcast services is considered. Since the choice of spectrum available for RF power limited the systems performance, the relative capacity figure of merit for satellite down-link frequencies was tabulated. The effect of frequency choice on the earth terminals and the total systems cost is compared for stationary and fixed reflectors. It was found that between 500 to 750 MHz of spectrum bandwidth is the adequate capacity to be shared for satellite down-links with broadcast and mobile services without harming or limiting any operations in the portion of the spectrum from 450 to 1215 MHz. To share the spectrum most effectively, adequate bandwidth expansion should be used in the down links and small adaptive or adapted arrays should be used at the earth receiving terminals. S.S.

N70-27802# Naval Ordnance Lab., White Oak, Md.
THE INTERACTION OF CO2 LASER RADIATION AND WATER Final Report, Jun. 1968–Jun. 1969
Jeremiah R. Lowney and John B. Sullivan 7 Jan. 1970 24 p refs
(AD-702408; NOLTR-69-166) Avail: CFSTI CSCL 17/2

The output of a CO2 laser was focussed upon the surface of water to study the generation of sonic waves for air to water communication. A rotating mirror Q-switch system and an electrical pulsing system were used to obtain laser pulses. Continuous wave output was also investigated. In each case, there were three obvious effects from the interaction (1) generation of an acoustic wave in air; (2) generation of an acoustic wave in water; and (3) generation of a circular surface wave. The best efficiency for producing a water acoustic disturbance was about 10 to the -6th power. One part in 10,000 of the acoustic energy coupled into the water - the balance is dissipated in the air. Placing a transparent window on the surface enhanced the water acoustic wave so that it was comparable in energy to the air acoustic wave. It is concluded that the process is very lossy, although further improvements in laser engineering may yield better results. Author (TAB)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N70-26537# National Bureau of Standards, Washington, D.C. Office of Standard Reference Data.
EDPAC: UTILITY PROGRAMS FOR COMPUTER-ASSISTED EDITING, COPY-PRODUCTION, AND DATA RETRIEVAL
Carla G. Messina and Joseph Hilsenrath Jan. 1969 84 p refs
(NBS-TN-470) Avail: SOD $0.75

A description and listings are given of EDPAC, a package of five related utility computer programs: Scramble, Substitute, Search, Blocksearch, Justify, and their subroutines. These programs perform transformations on alphanumeric data. The programs have been written in FORTRAN, with care taken to make them as system and machine-independent as possible, permitting their use on many different computers. Scramble scans an input file for specified characters, which it replaces by different characters. Substitute similarly replaces strings of characters by other strings. Search and Blocksearch scan for the occurrence of certain strings and list the lines or blocks, respectively, in which they occur. Justify produces text, for printing on a card-controlled typewriter or on an extended character printer, which has been left and right-justified between specified margins. Some applications of the EDPAC programs are discussed. Emphasis is placed on computer-assisted text preparation. Author

N70-26610# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
TABLE LOOKUP TECHNIQUES
C. E. Price 17 Dec. 1969 58 p refs
(Contract W-7405-eng-26)
(CTC-22) Avail: CFSTI

Consideration is given to basic methodology for table searching in computer programming. Only static tables are treated but references are given to techniques for handling dynamic tables. Methods described are: sequential search, merge search, binary search, estimated entry, and direct entry. The rationale of key transformation is indicated, and methods of 'hash addressing' are referenced. A general guide to technique selection is given in conclusion. Author (NSA)

N70-26619# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
ON-LINE REACTIVITY CALCULATOR
E. Viehl Apr. 1969 19 p In GERMAN
(FMRB-14/69) Avail: AEC Depository Libraries

Different circuits of reactivity calculators are described, which can be programmed on usual analog computers. A circuit is shown, which is capable to calculate the single reactivities of a coupled core configuration as well as the total reactivity. Author (NSA)

N70-26753# Joint Publications Research Service, Washington, D.C.
THE PROBLEM OF LARGE SYSTEM EFFECTIVENESS
G. K. Stolyarov *In its* Cybernetics and Regulation Theory 19 Feb. 1970 p 1–7 refs (See N70-26752 13-19)
Avail: CFSTI

A macromodel of an information control system C consisting of a target O and controlling system Y connected to each other by a flow of control information is considered. The target is assumed to belong to the class of large systems in the sense of a given classification. The fact that the controlling system belongs to this class is considered a consequence of the required similarity of Y and O. The effect of the restrictions in O and Y on the attainable values of the efficiency of C is investigated. Author

N70-26754# Joint Publications Research Service, Washington, D.C.
IMPOSSIBILITY OF ELIMINATING COMPLETE SORTING WHEN CALCULATING FUNCTIONS WITH RESPECT TO THEIR GRAPHS
M. I. Dekhtyar *In its* Cybernetics and Regulation Theory 19 Feb. 1970 p 8–13 refs (See N70-26752 13-19)
Avail: CFSTI

In preliminary formulation of a calculating function, let A conceive some function the values of which B tries to guess; B is permitted to ask questions of the type f(y) = z to which A must give answers (yes or no). The strategy of the complete sort for B consists in the fact that for each x, B successively asks f(x) = 0, f(x) = 1, etc. until a positive answer is received. Exact definitions are given for the concepts of guessing strategy, complete sorting, and their complexity in terms of calculating Turing machines with an 'oracle' and complexity of the calculations. Studies are cited for two situations which confirm the Trakhtenbrot hypothesis regarding the impossibility of eliminating the complete sort. Author

N70-26769# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
NATURAL COMMUNICATION WITH COMPUTERS 2 Final Report, 1 Aug. 1967–30 Sep. 1969
Daniel G. Bobrow 31 Oct. 1969 51 p refs
(Contract F19628-68-C-0125; ARPA Order 627)
(AD-700817; BBN-1893; AFCRL-69-0523) Avail: CFSTI CSCL 9/2

The paper reports on research to develop techniques to facilitate natural communication between computers and people, other computers, and real time devices. The work is divided into tasks

covering representation of semantic information, special purpose languages, real time input-output, pattern recognition, and time sharing research and modeling. TAB

N70-26780# Naval Research Lab., Washington, D.C.
CROSS-SECTIONAL PLOTS OF PLANE INTERSECTIONS: AN ADAPTATION OF THE APT SYSTEM Interim Report
Kingsley P. Thompson 27 Jan. 1970 73 p
(AD-701691; NRL-7025) Avail: CFSTI CSCL 9/2

The APT (Automatically Programmed Tooling) system provides for the software description of geometric forms, the delineation of a tool path, and, for output, discrete positioning information on punched paper tape for use by a numerically controlled machine. The CROSEC (Mod 1) program, described in the report, provides a means of extending the use of the canonical forms of the plane surfaces defined by the programmer in the part program by providing a plotting capability in which the lines in intersection, within specified limits, between a cross-sectional plane and all other defined planes are shown. A visualization of the initial plane framework on which the cutting is to be performed is thereby provided. The cross sectional plane and its dimensional limits are controlled by one plane definition and two point definitions. The plot is supplemented by printer output that aids in the interpretation of the plot. The program is written in the framework of the CDC 3800 APT 2.1 configuration. No additional program overlays or segments are necessary. The report contains a discussion of the method used, subroutine descriptions, listings and flow-charts, implementation aids, and a sample run. Author (TAB)

N70-26835# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.
A TIME-SHARING AUDIO VISUAL DEVICE
Larry A. Griffith Jun. 1969 68 p refs
(Contract F44620-68-C-0015)
(AD-700437; AFOSR-70-0185TR) Avail: CFSTI CSCL 9/2

By combining the tasks of many users to provide a high volume of work for a computer system, the time-shared computer has made the use of computers by low volume users economically feasible. As a result many new applications for computers have developed. One such application is computer-aided instruction. As the interaction between computer and student must take place through the output terminal (i.e. it must be typed) there is a very real limit to the types of additional information the computer can supply. If the computer were able to activate audio and visual devices in addition to typing, its versatility as a teacher would be greatly increased. This paper is concerned with designing and building an audio-visual terminal device for time-sharing systems. The device resulting from the project consists essentially of a slide projector and a tape recorder connected to the teletype output terminal in such a way that the computer can dynamically select any of the content of either device for presentation. Author (TAB)

N70-26864# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RECOGNIZING SYMBOLIC INFORMATION BY THE CORRELATED GROUP METHOD
V. M. Gorobtsov 4 Nov. 1969 18 p Transl. into ENGLISH from Tr. Vses. Konf. Po Inform.-Poiskovym Sistemam i Automatiz.-Vannoy Obrabotke Nauchn.-Tekh. Inform. 3d (Moscow), 1966 p 300–304
(AD-700397; FTD-MT-24-216-69) Avail: CFSTI CSCL 9/2

The recognition of some object which belongs to a particular set is defined as the procedure of detecting in this object those properties or symbols characteristic of the set, and one of symbols which applies only to it. The procedure for recognition of a set of such symbols is given in the form of two equations. It is asserted that the problem posed by this procedure is a fundamentally difficult one and that its final solution has as yet not been found, particularly in connection with the design of reading machines. Two possible approaches are offered. The first is to use training automata; for example, the kind of perception which automatically forms a set of symbols and a set of standards. The second approach is connected with the formation of these sets by a human operator. The problem arises of constructing criteria for defining the elements of the set so that they would take into account all possible forms of defective symbols in the set. TAB

N70-26892# RAND Corp., Santa Monica, Calif.
USER'S MANUAL FOR APAREL: A PARSE-REQUEST LANGUAGE
R. M. Balzer Jan. 1970 44 p refs
(Contract DAHC 15-67-C-0141)
(AD-701723; RM-6104-ARPA) Avail: CFSTI CSCL 9/2

The Memorandum is a users manual for APAREL, which is a parse-request language. It describes the features that have and have not been implemented, the restrictions on the use of these facilities, the new features added to APAREL since the publication of APAREL--A Parse-Request Language (AD-677 268), the method of invoking the available facilities, and ideas on the effective and efficient use of APAREL. Author (TAB)

N70-26927# Electronic Associates, Inc., Princeton, N.J. Princeton Computation Center.
RESEARCH AND DEVELOPMENT OF PARALLEL HYBRID MODELS Final Report, 15 Apr. 1968–28 Feb. 1969
Ronald M. Maslo 15 Mar. 1969 287 p refs
(Contract F19628-68-C-0328)
(AD-700792; AFCRL-69-0155) Avail: CFSTI CSCL 9/2

The contractor has studied methods for establishing computer models for problems submitted by laboratory scientists and mathematicians. These problems were then implemented for solution on the Parallel-Hybrid System. Thirteen problems were submitted during the year. They were from the fields of balloon dynamics, space chemistry, orbital mechanics, space physics, dynamics and electronic circuit design. Significant results were obtained in eleven of the problems. TAB

N70-26953# RAND Corp., Santa Monica, Calif.
POGO USER'S MANUAL. PART 1: GENERAL AIDS TO GRAPHIC PROGRAMMING
J. E. Rieber and V. R. Lamb Jan. 1970 192 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-701722; RM-6114-PR) Avail: CFSTI CSCL 9/2

Pogo Programmer-Oriented Graphics Operation is a software package for interactive computer graphics that is intended to simplify the programming process in two ways: (1) Unburdening the programmer of process of specifying interactive computer-graphics pages (CRT displays) by transcribing coordinates from layout paper and stringing together calls to graphic-support subroutines. (2) Permitting programmers to create interactive computer-graphics programs without spending much time learning the intricacies of the graphic subroutine package. The Memorandum describes one phase of the project - A package of software aids for interactive-graphics programs. The package consists of two parts: (1) DESIGN-a program that allows a user to 'draw' his displays on the face of the 2250 using the RAND Tablet and (2) A set of 'execution-time' subroutines that allows him to re-create and interact with these displays easily. TAB

N70-27010# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPATIBILITY OF DIGITAL COMPUTERS IN A PARTICULAR COMPUTING COMPLEX
E. E. Zulfugarzade 4 Sep. 1969 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk Azerb. SSR, Ser. Fiz. Mat. i Tekhn. Nauk (Baku), no. 2, 1966 p 71–75
(AD-701026; FTD-HT-23-552-68) Avail: CFSTI CSCL 9/2

The machine compatibility considered includes uniform programming, easy recoding of one machine program into the languages of the other machines of the complex, the selection of registers of the various machines and the recoding of words in one format into words of another format, and the management and exchange of information between the machines in the complex. Problems involved depend largely on the cycling speeds of the arithmetic units, operational memories, input-output units, the structures of the functional algorithms, and system configurations in the light of machine compatibility. The complex studied consists of digital computers and digital-incremental machines. The organization of the various parts of the system to solve various problems is considered in detail. TAB

N70-27038# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON ERRORS OF COMPUTER DEVICES FOR AIRCRAFT
V. A. Papov 20 Dec. 1969 13 p refs Transl. into ENGLISH from Samoletostroenie i Tekhn. Vozdushnogo Flota (USSR), no. 13, 1968 p 44–47
(AD-701139; FTD-MT-24-300-69) Avail: CFSTI CSCL 9/2

The main sources of error in specialized aircraft computers are examined. Since instrument error is largely due to limited digit capacity, it is pointed out that rational selection of digit capacity requires analysis of the algorithms to be realized, so as to determine the accuracy of solution of a given problem. The effect of errors in the computer on the quality of the control system should also be evaluated. Standard expressions are derived for determining the maximum absolute error of a product, a sum of products, and a polynomial. These can be used to find the error of numeric algorithms and to select digit capacity. TAB

N70-27045# Sandia Corp., Albuquerque, N.Mex.
DIGITAL COMPUTER SOLUTION OF LAPLACE'S EQUATION INCLUDING DIELECTRIC SURFACES
Jack E. Boers Dec. 1969 67 p
(SC-RR-69-446) Avail: CFSTI

A digital computer program was written for the solution of Laplace's equation and the plotting of the equipotentials. The program simulates both axially symmetric and rectangular configurations, including dielectric interfaces, on a large matrix of up to 201 x 201 points. It is written in the CDC 3600-6600 FORTRAN 4 programming language and employs the Stromberg-Carlson 4020 computer recorder for plotting. Solutions with errors of less than 1 percent are easily obtained in less than 10 minutes on the CDC 3600 and less than 2 minutes on the CDC 6600. A detailed description of the input data is presented. Author

N70-27079# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.
THE ALOHA SYSTEM Annual Report, 1969
Norman Abramson Feb. 1970 53 p refs
(Contract F44620-69-C-0030)
(AD-701417; AFOSR-70-0416TR) Avail: CFSTI CSCL 9/2

The program is aimed at (a) developing a system of radio-linked consoles to be integrated into the present time-sharing system and (b) strengthening research in information processing through projects which will develop and use the on-line and interactive graphics features of the system. A primary goal of this program is to add radio links connecting various units of the University of Hawaii throughout the state to the existing University of Hawaii on-line computer system, the project has been named the Additive Links On-Line Hawaii Area System - THE ALOHA SYSTEM. Author (TAB)

N70-27171*# Arizona Univ., Tucson. Computer Science Research Lab.
LOCUT1: A TEST PROGRAM FOR THE PDP-9/LOCUST HYBRID INTERFACE
W. R. Moore Jan. 1970 32 p refs
(Grant NGL-03-002-024)
(NASA-CR-109843; CSRL-Memo-199) Avail: CFSTI CSCL 09B

LOCUT1 is a FORTRAN 4 main program which calls MACRO 9 subroutines to test the hybrid computer interface between a PDP-9 digital computer and the LOCUST high speed iterative analog computer. The programs are written to provide the user with all information needed to perform the tests. The programs give patching and test operating instructions and print out diagnostic messages on the teletype to point out any malfunction in the interface. Author

N70-27183*# Radiation, Inc., Melbourne, Fla.
ADVANCED MEMORY AND MEMORY SEQUENCER (MAMS) Final Design Report
6 Mar. 1970 84 p
(Contract NAS5-21035)
(NASA-CR-109827) Avail: CFSTI CSCL 09B

A study was undertaken to investigate the feasibility of reducing the physical size of the Nimbus-D VIP memory and memory sequencer modules through the use of LSI techniques, while retaining their functional capacity. The report describes the design goals, priorities, and functional characteristics, and gives a detailed view of the electrical and mechanical design approaches employed. It concludes that a system using MOS technology for both memories and logic, dissipating slightly over 1 watt, can be packaged in a Nimbus size 1/0 housing without undue design risk. The approach makes maximum use of microprogramming and, except for some custom control logic, uses standard parts and techniques. It is recommended that a system such as described be developed for use with Nimbus and other information-gathering projects which place a premium on low size, weight, and power, yet require a large and flexible information processor. Author

N70-27285*# National Aeronautics and Space Administration, Electronics Research Center, Cambridge, Mass.
TASK SCHEDULING FOR A REAL TIME MULTIPROCESSOR
John W. Jordan Washington May 1970 24 p refs
(NASA-TN-D-5786) Avail: CFSTI CSCL 09B

An algorithm for scheduling real-time tasks in a multiprocessor system is described. The algorithm guarantees that the deadlines of all scheduled tasks will be met. If the number of active tasks exceeds the capability of the multiprocessor, then only the highest priority tasks will be scheduled. The algorithm is suboptimal in that it may fail to schedule one or more low-priority tasks which could be accommodated. A hardware implementation of the algorithm is discussed. Author

N70-27350*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
FORTRAN 4 PROGRAM FOR COMPUTATION OF GROUP TABLES OF FINITE GROUPS: PROGRAM FOR SECOND GENERATION MACHINES
David D. Evans and Gabriel Allen Washington May 1970 38 p refs
(NASA-TM-X-2015) Avail: CFSTI CSCL 09B

The method depends on the fact that every finite group G, of order n, is isomorphic to some subgroup T sub n of the symmetric group S sub n. The procedure for using the program is as follows: After finding the T sub n which is isomorphic to G, the user enters the elements of T sub n into the program as input data. The group table for T sub n is computed and printed. Using the isomorphism between T sub n and G, the user then translates back to the elements of G. The group A sub 5, the even permutation subgroup of S sub 5, is shown as an example. Author

N70-27366# Erlangen Univ. (West Germany). Technische Fakultaet.
COMPUTER STRUCTURE AND OPERATING SEQUENCE:

ANALYSIS AND SIMULATION [RECHNERSTRUKTUR UND ABLAUFGESCHEHEN IN RECHENANLAGEN: ANALYSIS UND SIMULATION]

Peter Paul Spies (Ph.D. Thesis) 1969 136 p refs In GERMAN
Avail: CFSTI

The application of on-line and time-sharing systems leads to very complex operating sequences. Of foremost importance is the question, whether an operational program can organize the activity of a computer in such a way that several external requirements can be fulfilled while equipment elements are economically used at the same time. In the treatment of this question the effectiveness of systems structures can be observed and this question is investigated using models for programs and computer lay-outs. ESRO

N70-27381*+ Arizona Univ., Tucson. Computer Science Research Lab.

A HYBRID-COMPUTER DATA-CHANNEL INTERFACE AND ITS APPLICATION TO THE SIMULATION OF VARIABLE TIME DELAYS

M. Naka (Natl. Aerospace Lab., Tokyo) Jan. 1970 39 p refs
(Grant NGL-03-002-024)
(NASA-CR-109838; CSRL-Memo-197) Avail: CFSTI CSCL 09B

Implementation of a data channel interface for the ASTRAC 2 high speed iterative differential analyzer and the PDP-9 digital computer, and its application to the simulation of variable time delay (e.g. pipeline delays in aerospace and chemical problems) are described. The cycle stealing data channel interface effects automatic block transfers of data from reflection must be considered. to the digital computer at rates of up to 250,000 words per second in response to request pulses from the analog computer. Variable time delays can be implemented if analog data read in and stored at a constant sample rate are read out into a digital to analog converter at a variable rate established by a voltage controlled oscillator patched on the analog computer. A simple integral equation was solved to test implementation of (constant) time delays. Author

N70-27479# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HIGH FREQUENCY SINGLE-CYCLE SHIFT REGISTER

L. K. Samoylov 18 Sep. 1969 21 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Elektromekh. (USSR), no. 2, 1968 p 141-147
(AD-701138; FTD-MT-24-209-69) Avail: CFSTI CSCL 9/2

A transistorized single-cycle shift register capable of operating at frequencies up to 8 MHz is described. The circuit functioning is analyzed, the component values are calculated, and the types of transistors and diodes are selected. In this circuit, the power gain may exceed unity, which permits designing multicycle shift registers. The gain is independent of frequency and of active-element parameters. A 2-MHz register of this type hooked up with P416B transistors and D18 diodes was tested. It exhibited satisfactory functioning with a frequency variation of plus or minus 10 percent and at temperatures up to 60C. TAB

N70-27545# Sandia Corp., Albuquerque, N.Mex.

MODELING FOR THE SCEPTRE CIRCUIT ANALYSIS PROGRAM

D. N. Harstad Nov. 1969 18 p refs
(SC-DR-69-760) Avail: CFSTI

The permanent model library which was developed for use with the SCEPTRE program is described. In order to use the model library, the user must be aware of the characteristics and limitations of each model. Author (NSA)

N70-27579*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.

CONVOLUTIONAL CODING TECHNIQUES FOR DATA PROTECTION Quarterly Progress Report, 16 Nov. 1969 – 15 Feb. 1970

James L. Massey, J. Chang, J. Geist, W. Hartman, and G. Seguin 2 Mar. 1970 10 p refs
(Grant NGL-15-004-026)
(NASA-CR-109773) Avail: CFSTI CSCL 09B

A flow chart is given for a modified Fano sequential decoding algorithm. A forward blocking value is introduced and is made to contain the largest value of all the node values on nodes which are blocking any further forward moves. A class of complementary rate 1/2 non-systematic codes for sequential decoding is discussed. Sub-baud codes are investigated for selection of n bit sequences to control the polarity of the modulated envelope in each 1/n th of the basic baud waveform. Such codes are used for bandwidth spreading to reduce multipath and multi-user interference. R.B.

N70-27588# Commissariat a l'Energie Atomique, Vaujours (France).

INPUT-OUTPUT SUPERVISOR [LE SUPERVISEUR D'ENTREE-SORTIE DANS LES ORDINATEURS]

Roger Dupuy (Ph.D. Thesis—Paris Univ., 28 Apr. 1969) Jan. 1970 90 p refs In FRENCH; ENGLISH summary
(CEA-R-3860) Avail: CFSTI

The input-output supervisor is a program which monitors the flow of information between the core store and peripheral equipment of a computer. This report deals with: (a) a study of a generalized input-output supervisor which with simple modifications looks like most input-output supervisors which are now running on computers; (b) application of this theory to a magnetic drum; (c) hardware requirements for time-sharing. Author (ESRO)

N70-27619# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Satellitenelektronik.

THE INVESTIGATION OF WOVEN-PLATED WIRE MEMORY (NDRO) [UNTERSUCHUNGEN AN DRAHTSPEICHERN MIT NICHT ZERSTOERENDEM AUSLESEN]

Rudolf Stolber Dec. 1969 59 p In GERMAN; ENGLISH summary
(DLR-FB-69-97) Avail: CFSTI

The electrical characteristics of woven-plated wire memory, a new device for data storage were examined over the temperature range from −50 to + 125 deg and the effects of changing the nominal currents in the write-in and read-out on the read output voltage and the switching thresholds were determined. At temperatures above 75 deg special compensation measures were necessary to ensure stable electrical operation and a method for determining them is given. Author (ESRO)

N70-27627# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A DEVICE FOR AUTOMATIC CODING AND INPUT OF IMAGES FROM BLACK-AND-WHITE PHOTOGRAPHS INTO AN EVM

V. A. Lvov et al 1 Oct. 1969 19 p Transl. into ENGLISH from Peredovoi Proizv.-Tekhn. Opyt (Moscow), no. 19, 1967 p 1 – 13
(AD-700344; FTD-HT-23-948-68) Avail: CFSTI CSCL 9/2

A device has been developed and tested for automatic coding and input of black-and-white images into a Minsk-2 electronic computer. The optical-mechanical part of the FTA-P photo telegraph transmitter is used to read the images. The rate of coding is 120 lines per minute. The size of the photograph which can be encoded is determined by the number of lines scanned, the number of

elements per line and by the available storage capacity of the computer. The maximum resolution capability of the device is 0.3 mm. TAB

N70-27649# Entelek, Inc., Newburyport, Mass.
COMPUTER-ASSISTED INSTRUCTION INFORMATION EXCHANGE Final Technical Report, 1 Feb. 1965–31 Dec. 1969
Albert E. Hickey 15 Feb. 1970 36 p
(Contracts Nonr-4757(00); N00014-68-C-0236)
(AD-701715) Avail: CFSTI CSCL 5/2

The paper is the final technical report on the establishment and operation of an Exchange of Information among universities, corporations and government agencies concerned with the use of the computer as an aid to the instructional process. Four modes of information exchange are described: (1) a monthly dissemination of information on cards, (2) conferences, (3) a workshop and (4) an annual integration of the data. TAB

N70-27676# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Aachen (West Germany). Inst. fuer Theoretische Gasdynamik.
SYMPOSIUM ON HYBRID COMPUTERS IN AERONAUTICS AND ASTRONAUTICS, PART 2 [SYMPOSIUM HYBRIDRECHNER IN LUFT- UND RAUMFAHRT, 2. TEIL]
A. Kurau May 1969 209 p refs Partly in GERMAN and partly in ENGLISH Symp. held at Meersburg, West Ger., 9–11 Oct. 1967
(DLR-FB-69-32; DVL-782) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 46,90 DM

CONTENTS:

1. ON THE TREATMENT OF OPTIMIZATIONS BY MEANS OF PONTRYAGIN'S MAXIMUM PRINCIPLE ON A HYBRID COMPUTER W. Bub (Electron. Assoc. Inc., Brussels) p 7–45 refs (See N70-27677 13-19)

2. THE SIMULATION OF EUROPA 1 LAUNCH VEHICLE H. Bittner (Ko Alkow) p 47–83 (See N70-27678 13-31)

3. HYBRID SIMULATION OF PROPELLANT SLOSHING IN LARGE ROCKET VEHICLES A. Grundmann (Bo Alkow) p 85–99 (See N70-27679 13-12)

4. SOFTWARE REQUIREMENTS FOR SIMULATION, DATA PROCESSING, AND EXPERIMENT INTEGRATION G. Jung (Dornier-Werke) p 101–128 (See N70-27680 13-08)

5. REQUIREMENTS FOR A HYBRID COMPUTER SUITABLE FOR SIMULATION, DATA ANALYSIS AND EXPERIMENT INTEGRATION H. Roderer (Dornier-Werke) 129–151 (See N70-27681 13-08)

6. INTERFACE AND PROGRAMMING PROBLEMS IN EXISTING SIMULATION SYSTEMS WITH ANALOG AND DIGITAL COMPUTERS W. Scha Afer (Ges. fu Ar Rechnergesteuerte Anlagen m.b.H.) p 153–171 (See N70-27682 13-08)

7. PROGRAMMING AND SOFTWARE FOR HYBRID COMPUTATION J. B. Everest (Redifon Astrodata Ltd.) p 173–180 (See N70-27683 13-08)

8. HARDWARE AND SOFTWARE FOR CAE HYBRID COMPUTERS K. Bracht (Compagn. Europe Aenne d'Automatisme Electron., Frankfurt) p 181–216 (See N70-27684 13-08)

N70-27680# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Hybrid-Rechenzentrum.
SOFTWARE REQUIREMENTS FOR SIMULATION, DATA PROCESSING, AND EXPERIMENT INTEGRATION [FORDERUNGEN AN DIE SOFTWARE FUER SIMULATION, DATENVERARBEITUNG UND VERSUCHSINTEGRATION]
G. Jung *In* DVFLR Symp. on Hybrid Computers in Aeron. and Astronaut., Pt. 2 May 1969 p 101–128 In GERMAN (See N70-27676 13-08)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 46,90 DM

The software system used for a hybrid computer in the acquisition and processing of flight test data from the DO-31 aircraft is described. The calibrating curves are stored together with the measured data on magnetic tape, for redundancy reasons, both on the ground and on board the aircraft by means of PCM and PAM. Also a master control program is described which permits a high flexibility in function block testing, parameter assignment, and mode control. ESRO

N70-27681# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Hybrid-Rechenzentrum.
REQUIREMENTS FOR A HYBRID COMPUTER SUITABLE FOR SIMULATION, DATA ANALYSIS AND EXPERIMENT INTEGRATION [FORDERUNGEN AN EINE HYBRIDRECHENANLAGE, DIE FUER SIMULATION, DATENAUFBEREITUNG UND VERSUCHSINTEGRATION GEEIGNET IST]
H. Roderer *In* DVFLR Symp. on Hybrid Computers in Aeron. and Astronaut., Pt. 2 May 1969 p 129–151 In GERMAN (See N70-27676 13-08)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 46,90 DM

The computer layout of a system configuration for a hybrid computer center depending on the operational requirements is described. In the aerospace industry, these requirements pertain to the simulation of man-machine systems, simulation with the integration of real components (gyros), and experiment integration. The limitations arising from these requirements for the hardware design, the program languages and the peripheral equipment are discussed. ESRO

N70-27682# Gesellschaft fuer Rechnergesteuerte Anlagen m.b.H., Wuppertal-Barmen (West Germany).
INTERFACE AND PROGRAMMING PROBLEMS IN EXISTING SIMULATION SYSTEMS WITH ANALOG AND DIGITAL COMPUTERS [KOPPEL- UND PROGRAMMFRAGEN BEI AUSGEFUEHRTEN ANLAGEN MIT ANALOG- UND DIGITAL-RECHNERN FUER SIMULATIONEN]
W. Schaefer *In* DVFLR Symp. on Hybrid Computers in Aeron. and Astronaut., Pt. 2 May 1969 p 153–171 In GERMAN (See N70-27676 13-08)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 46,90 DM

The range of hybrid computers available from the Ferranti company is described. Features of the conversion interfaces between both the digital and the analog computer, and the peripheral devices are outlined. The importance of image tube applications is stressed. ESRO

N70-27683# Redifon Astrodata, Ltd., Little Hampton (England).
PROGRAMMING AND SOFTWARE FOR HYBRID COMPUTATION
J. B. Everest *In* DVFLR Symp. on Hybrid Computers in Aeron. and Astronaut., Pt. 2 May 1969 p 173–180 (See N70-27676 13-08)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 46,90 DM

Some problems of hybrid software are outlined, concerned with implementing a mathematical model and presenting all variables simultaneously. Priority interrupts and problems of program hierarchy are also discussed. ESRO

N70-27684# Compagnie Europeenne d'Automatisme Electronique, Frankfurt (West Germany).
HARDWARE AND SOFTWARE FOR CAE HYBRID COMPUTERS [HARD- UND SOFTWARE FUER HYBRID-RECHENANLAGEN MIT DER CAE-ANLAGE]
K. Bracht *In* DVFLR Symp. on Hybrid Computers in Aeron. and Astronaut., Pt. 2 May 1969 p 181–216 In GERMAN (See

N70-27676 13-08)
Avail: CFSTI: Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 46.90 DM

The CAE, Compagnie Europe Aenne d'Automatisme Electronique, has developed a series of hybrid computers, where analog computers from various manufacturers have been integrated into the systems. The interface elements and their priority operation is described, and the properties of the real time software are outlined. Program languages are available on different levels. Hardware features, such as memory structure, interrupt system, floating point arithmetic, multiplex and selector channels, and memory addressing, are also described. ESRO

N70-27798# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
A USER SPECIFIES SOFTWARE FOR HYBRID COMPUTING, NOVEMBER 1968–JUNE 1969
Laurance Krasno Los Angeles AF Sta. SAMSO 15 Dec. 1969 21 p
(Contract F04701-69-C-0066)
(AD-702437; TR-0066(5306)-14; SAMSO-TR-70-95) Avail: CFSTI CSCL 9/2

A functional approach to specifications writing for hybrid software is presented. In this approach a facility states only its requirements and leaves system designing to the vendor. It can be used by any facility regardless of its requirements. Author (TAB)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N70-26543# Bell Telephone Labs., Inc., Allentown, Pa.
PROCUREMENT SPECIFICATION TECHNIQUES FOR HIGH-RELIABILITY TRANSISTORS
C. H. Zierdt, Jr. [1969] 59 p refs
(AL-2831-CHZ-ETB) Avail: CFSTI

The various reliability-assurance purposes which part procurement specifications are intended to serve are enumerated. Using the techniques presented, procurement specifications can control essentially-constant transistor failure rates near the .001%/1000 hour level, a consistent failure-rate level can be obtained from variable-quality input populations for each lot tested, without dependence on historical data accumulation, and these results can be achieved at relatively low cost on large or small lots of products. Author

N70-26548 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATIONS OF ELECTRIC ARES [UNTERSUCHUNGEN AM ELEKTRISCHEN LIEHTBOGEN]
H. Plesse Oct. 1969 16 p Transl. into ENGLISH from Ann. Physik v. 22, no. 5, 1935 p 484–494
(NLL-SMRE-Trans-5790-(6313.4)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Properties of electric arcs are studied and considered in relation to mine safety research. Almost all tests were made with nickel electrodes. Observed were the following effects: (1) metal vapor introductions into arc discharge path; (2) evaporation of insulating materials on electrodes with glow discharge; and (3) various types of voltage curves and frequency oscillations obtained with different metal electrodes. G.G.

N70-26597*# Bendix Corp., Southfield, Mich. Research Labs.
DESIGN AND FABRICATION OF COMPACT FOUR-PORT TRIPLEXING FILTERS Final Report
R. J. Wenzel Mar. 1970 65 p refs
(Contract NAS12-2133)
(NASA-CR-86388; Rept-5213) Avail: CFSTI CSCL 09E

A series of four-port triplexing filters for broadband harmonic doublers is described. The filters are designed to achieve specified performance in a structure of minimum complexity, size, and weight. The measured performance for four complete multiplexer units covering L-band through Ku-band is given. Author

N70-26689# Akademiya Nauk URSR, Kiev.
DESIGNING CERTAIN TYPES OF RC FILTERS FOR ACOUSTICAL MEASUREMENTS
I. M. Vishenchuk and A. M. Ler *In its* Appl. Acoustics and Vibration Technol. 1968 p 92–104 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

The frequency characteristics of RC filters can be obtained by approximating the frequency characteristics using either Butterworth or Chebyshev polynomials. The Butterworth polynomial ensures the smoothest maximum approximation to the ideal square-wave frequency characteristic of the filter. The Chebyshev polynomial ensures uniform oscillation approximation to the ideal frequency characteristic in the transmission band; in the attenuation band damping increases monotonically with frequency. Methods are proposed for computing the parameters of the filter circuits. These methods ensure the optimal shape of the frequency characteristics according to the proper polynomial. Transl. by H.W.

N70-26690# Akademiya Nauk URSR, Kiev.
EXPANDING THE MEASUREMENT LIMITS OF ELECTRONIC PHASE METERS
A. M. Agizim *In its* Appl. Acoustics and Vibration Technol. 1968 p 105–109 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

Certain methods are studied for deriving a single-value reading within the limits of one or several periods when determining phase shift using typical phase indicator devices. These devices include: a phase meter using Lissajous figures, a phase meter with an overlap device, and a phase meter with a trigger phase measuring device. Transl. by H.W.

N70-26691# Akademiya Nauk URSR, Kiev.
SQUARE WAVE GENERATOR FOR ACOUSTICAL MEASUREMENTS
V. V. Belousko, V. F. Petrov, and Yu. I. Spektor *In its* Appl. Acoustics and Vibration Technol. 1968 p 110–116 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

A square wave generator is studied with independent regulation of pulse duration and frequency. A method is described for the technical design of a generator based on controlled p-n-p-n switches consisting of p-n-p and n-p-n transistors. Transl. by H.W.

N70-26692# Akademiya Nauk URSR, Kiev.
PORTABLE TRANSISTORIZED ECHO SOUNDER
V. V. Belousko, G. N. Vasilyev, V. F. Petrov, and Yu. I. Spektor *In its* Appl. Acoustics and Vibration Technol. 1968 p 117–124 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

The measuring circuit of the device is described for measuring depths to 150 meters. Visual readout of the echo signal is accomplished by using a cathode ray tube. Transl. by H.W.

N70-26694# Akademiya Nauk URSR, Kiev.
SOUND RANGING SYSTEM FOR EXPOSING INHOMOGENEITIES IN ROCKS

Ya. Ye. Belenkiy, V. N. Mikhaylovskiy, and V. N. Pervushin *In its* Appl. Acoustics and Vibration Technol. 1968 p 130–135 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

The system uses two mutually complementary geoacoustical methods: the frequency-selective shadow which is exposed during sounding by measuring the relationship of amplitude to the vibration frequency at various points of the observation profile, and the reflection method, which is accomplished by measuring the time segments between the forward fronts of the transmitted and reflected pulses at maximum fixed signal frequencies. Transl. by H.W.

N70-26697# Akademiya Nauk URSR, Kiev.
MULTIPHASE BISTABLE MULTIVIBRATOR
Ya. Ye. Belenkiy *In its* Appl. Acoustics and Vibration Technol. 1968 p 154–164 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

The circuit of a multiphase bistable multivibrator is described, which is the most economical and universal circuit of a multichannel distributor in step-by-step and cyclic modes. The qualitative theory of operation is given for the open network of the circuit and recommendations are made for achieving the multiphase mode. Based on the theoretical analysis, functions are obtained for calculating the basic parameters of the circuit in the described modes. Transl. by H.W.

N70-26698# Akademiya Nauk URSR, Kiev.
TEMPERATURE STABILITY OF MULTIVIBRATORS WITH BYPASS SILICON DIODES
L. I. Kompaniyets and A. N. Lenovenko *In its* Appl. Acoustics and Vibration Technol. 1968 p 165–173 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

A known circuit is described for a bistable multivibrator using germanium transistors with silicon-diode temperature stabilization. Formulas are derived for calculating the temperature stability of the pulse duration. The formulas take into account the effect of the reverse current of the closed transistor base, and also the voltage changes in the diode and in the emitter junction. Recommendations are given for increasing the temperature stability of the pulse duration. Transl. by H.W.

N70-26765# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LANTHANUM HEXABORIDE AND ZIRCONIUM CARBIDE DIRECTLY HEATED CATHODES FOR AN INJECTOR-BUNCHER
V. F. Gass 29 Jul. 1969 7 p refs Transl. into ENGLISH from Uskoriteli (USSR), no. 7, 1965 p 83–85
(AD-700586; FTD-HT-23-460-68) Avail: CFSTI CSCL 20/7

ZrC cathode spikes with points having about 1 mu radius were made by the electro-forming process in a 4 percent NaF solution. LaB6 cathodes were formed in an H3PO4 electrolyte. The properties of these new cathodes were tested under varying current, temperature and vacuum conditions. The results are graphed and relative advantages of the two types are compared. TAB

N70-26778# Naval Postgraduate School, Monterey, Calif.
A NANOSECOND MICROWAVE BURST GENERATOR USING RESONANT BUILDUP FOR OUTPUT PEAK POWER ENHANCEMENT
Roy Lafayette Ray, Jr. (M.S. Thesis) Jun. 1969 41 p refs
(AD-701675) Avail: CFSTI CSCL 9/5

A system has been developed for generating nanosecond-order pulses of microwave energy with the output pulse amplitude considerably higher than the input CW source level. The system uses a PIN diode switched waveguide cavity for a pulse forming device. The output pulse width is shown to be directly proportional to the actual cavity length. Minimum pulse width and degree of enhancement of the output amplitude are shown to be a function of the switching time and loss characteristics of the switch. Pulse widths as narrow as 4.3 nsec and enhancements as high as 4.8 dB were obtained using pulse repetition rates from zero to 500 KHz. The output level enhancement feature of this system is its chief advantage over other nanosecond RF pulse generators. Other advantages of the system are its relative low cost, simplicity of tuning, versatility of pulse width and repetition rate, and its adaptability for rugged construction. Author (TAB)

N70-26790# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRON-OPTICAL FREQUENCY MULTIPLIER
A. G. Zharov et al 17 Oct. 1969 14 p refs Transl. into ENGLISH from Teoriya i Sredstva Automat. (Moscow), 1968 p 326–330
(AD-700594; FTD-MT-24-288-69) Avail: CFSTI CSCL 20/6

Recent developments in electron optics in the area of optically modulated frequency multiplication are discussed. The multipliers discussed employ modulators built around gallium arsenide and gallium phosphide diodes and KDP and ADP dihydrophosphates crystals. TAB

N70-26911# Naval Research Lab., Washington, D.C. Electron Physics Branch.
INTERMITTENT POWER SOURCE FOR BEACONS Final Report
J. M. Marzolf Jan. 1970 10 p
(AD-701690; NRL-MR-2081) Avail: CFSTI CSCL 17/7

A circuit is proposed for operation of various types of beacons (audio, sonar, visual or radio) which is relatively simple, versatile and capable of suppling large powers. It is basically a static inverter with the added feature of intermittently stopping and starting the oscillation. The inverter is designed for direct operation of an audio output. It is highly versatile since it can be designed for a wide range of input and output voltages, audio frequencies and on to off time ratios. Author (TAB)

N70-26918# Naval Civil Engineering Lab., Port Hueneme, Calif.
A STUDY OF POWER LINE FILTER RINGING: FILTER MODIFICATION TO REDUCE RINGING AND DEVELOPMENT OF A PORTABLE POWER LINE PULSE GENERATOR, JUNE 1968–FEBRUARY 1969
D. L. Chaffee, P. R. Kersten, and D. B. Clark Dec. 1969 49 p refs
(AD-700937; NCEL-TN-1066) Avail: CFSTI CSCL 9/1

The note presents a description of the development of a small, portable impulse generator for inducing a fast rising and short duration voltage pulse on an AC power system. The theory of operation is given along with complete circuit diagrams and construction details. Experimental test results obtained with commercially available AC power filters are included and various applications of the device are discussed. Means of damping power filter ringing are investigated and results presented along with recommendations for improved AC power filter design for applications where isolation from pulse type power voltage modulations is desirable. Author (TAB)

N70-26946# Army Electronics Command, Fort Monmouth, N.J.
MAXIMUM RF POWER TRANSISTOR COLLECTOR VOLTAGE
Bernard Reich, Edward B. Hakim, and Gregory J. Malinowski Jan. 1970 10 p refs
(AD-700952; ECOM-3212) Avail: CFSTI CSCL 9/1

The RF operating voltage of power transistors designed for operation in HF, VHF and UHF regions was found to be greater than previously realized. This higher operating voltage is attributed

to the slow response of the device surface with respect to the operating frequency of the circuit. Since most devices have breakdown voltages which are initially surface limited, their voltage operation at the higher frequencies is superior to the 60-cycle curve tracer behavior. Author (TAB)

N70-27018# Pittsburgh Univ., Pa. Dept. of Electrical Engineering.
THERMODYNAMICS OF THE FIELD-EFFECT Final Report
Horst Kunig Jan. 1970 119 p refs
(Contract N00019-69-C-0497)
(AD-701410) Avail: CFSTI CSCL 9/1

A new thermodynamic field-effect transistor theory is developed. The ultra-high frequency performance, power gain and switching speed of insulated gate as well as pn-junction field-effect transistors are derived under thermal constraints. Several practical device configurations are treated and their maximum frequency performance analyzed. Furthermore instabilities are related to the temperature distribution change with time in the device channel. A semiexperimental technique to quickly determine the maximum frequency performance of any device configuration is demonstrated. Author (TAB)

N70-27120*# Westinghouse Electric Corp., Baltimore, Md. Defense and Space Center.
DEVELOPMENT OF MNOS TECHNOLOGY Final Report
20 Mar. 1970 43 p refs
(Contract NAS9-6636)
(NASA-CR-108404; WEC-GO-HS-51431) Avail: CFSTI CSCL 09A

The objective of this task was to develop pyrolytic silicon nitride-on-silicon dioxide technology and to correlate the deposition parameters with physical and electrical characteristics of metal-nitride-oxide semiconductor structures (amplifying and memory). The theory and physical models of charge storage in MNOS structures is described in terms of the Fowler - Nordheim tunneling currents, Poole - Frenkel field enhanced thermal currents, ohmic currents, and ionic currents. Two limiting cases based on the presence or absence of deep traps at the nitride-oxide interface are shown to have significant effects on the magnitude of the flatband shift and charge retention. The experiments are all limited to thermally grown silicon dioxide in oxygen with temperature and partial pressures as variables. It was shown that on (100) silicon that the data extrapolates to an initial oxide thickness. The most significant experiments showed that there are large differences in both oxidation rate and conductivity caused by the presence of diffused boron regions. The conclusion is that thin thermal oxides should not be used on p channel MNOS transistors because of the anomolous behavior produced. Author

N70-27165*# Watkins-Johnson Co., Palo Alto, Calif.
DEVELOPMENT PROGRAM FOR 35 WATT TRAVELING-WAVE TUBE SPACE AMPLIFIER Final Report, 30 Jun. 1967 - 30 Sep. 1969
E. R. Dornseif, A. Spica, Jr., and G. C. Walters 30 Sep. 1969 191 p refs
(Contract NAS8-20787)
(NASA-CR-102657) Avail: CFSTI CSCL 09E

The approach implemented to realize a 35-watt, S-band traveling-wave tube amplifier (TWTA) to replace the present lower power S-band TWTA utilized in command and communication system downlink in the Saturn 5 instrument unit is outlined. The program consisted of the design and development of a high efficiency TWTA. A 42% efficient TWT, and an 85% efficient power conversion system was achieved. Power conversion system and traveling wave tube design considerations, detail design parameters, and test data on the complete power amplifier are presented. Author

N70-27193# Army Electronics Command, Fort Monmouth, N.J. Electronics Components Lab.
HIGH-POWER, FOUR-PORT, JUNCTION CIRCULATOR
Robert M. True and Edward E. De Camp, Jr. Jan. 1970 31 p refs
(AD-700957; ECOM-3210) Avail: CFSTI CSCL 9/1

The feasibility of a symmetrical, high-power, four-port, waveguide, junction circulator for operation at S band was demonstrated. Both H-plane and E-plane configurations were studied. The ferrites utilized in the circulators were polycrystalline yttrium-iron-garnet (YIG) materials doped with gadolinium (Gd), aluminum (Al), and dysporosium (Dy) in various combinations. In addition, various loading techniques and metallic center posts were evaluated. Single- and double-disk geometries were used with a magnetizing field applied along the ferrite axis in each design. The H-plane configuration has an insertion loss slightly above 1.0 dB, is power-limited at approximately 600 kW peak, 600 watts average, is physically larger than the E-plane design, and requires a comparatively large biasing field. The E-plane configuration can handle a greater amount of power, is lighter and more compact, operates with a lower biasing field, and the insertion loss is approximately 0.5 dB. High-power operation at 1.0 MW peak, 1.0 kW average was achieved. Author (TAB)

N70-27233*# Philco-Ford Corp., Blue Bell, Pa. Microelectronics Div.
SIXTEEN-CHANNEL MULTIPLEXER Final Report
Sep. 1968 28 p
(Contract NAS8-20890)
(NASA-CR-102644) Avail: CFSTI CSCL 09E

General descriptions, technical data, and circuit diagrams are presented for 16-channel MOS multiplexers. The devices were designed for use in applications requiring sequential or random-access multiplexing. These applications include telemetry, satellite communications, sample data systems, etc. The devices may also be used as 8-channel differential multiplexers. Use explanations and operation details are included. D.L.G.

N70-27268# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SOLID STATE CIRCUIT BREAKER FOR DIRECT CURRENT APPLICATION IN DEEP-SUBMERSIBLE SYSTEMS
J. L. Davis Dec. 1969 46 p refs
(AD-701158; LMSC-A960566) Avail: CFSTI CSCL 9/1

The objective of the project was to advance the capabilities of solid-state switching devices designed to interrupt large direct-current loads in deep-submersible power-distribution systems. These devices are generally installed in oil-filled enclosures where they are exposed to hydrostatic pressures equivalent to the vehicle operating depth. The program resulted in a solid-state device capable of switching direct currents up to 150 amp at a nominal 120 v and of performing circuit-breaker action with an inverse-time function for overload currents of from 151 to 400 amp. Electrical tests were performed on the prototype model under varying temperature and pressure conditons. TAB

N70-27344# AEG-Telefunken, Hamburg (West Germany).
RELIABILITY STUDY OF ELECTRONIC POWER SUPPLY COMPONENTS AND SYSTEMS [ZUR ZUVERLAESSIGKEITSUNTERSUCHUNG AN ELEKTRONISCHEN BORDNETZKOMPONENTEN UND -SYSTEMEN]
M. Ayvaci, J. Brueggemann, and K. Renk Mar. 1970 167 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-70-10) Avail: CFSTI; Zentralstelle fuer Luftfahrt Dokumentation und Inform. (ZLDI) Munich: 34.90 DM

Theoretical and practical methods of reliability estimation and reliability demonstration for electronic components and systems are quoted and discussed. A discussion of American standards leads to proposals for reliability demonstration especially with regard

to short time tests. Special electronic circuits for satellite onboard networks with high reliability are described with a theoretical analysis. Practical examples are added to most of the theoretical considerations. Author (ESRO)

N70-27460# Machlett Labs., Inc., Stamford, Conn.
FPS-85 TUBE IMPROVEMENT PROGRAM 4CPX250K Final Technical Report, 2 Feb. 1966 – 1 Dec. 1967
Werner Brunhart and Harold D. Johnson Jan. 1970 54 p
(Contract AF 33(602)-4037)
(AD-701424; EP-738; RADC-TR-68-13) Avail: CFSTI CSCL 9/1

The objective of the program was to investigate the areas where possible improvements could be made in order to provide tubes that would operate in the FPS-85 for a minimum of 4000 hours with a maximum of ten (10) arcs and a power output decrease not to exceed 3db. Also stressed in this program was the improvement of the mechanical strength of the cathode leader assembly to reduce the possibility of tube breakage due to rough handling or misalignment of tube sockets. Author (TAB)

N70-27473*# Bendix Corp., Teterboro, N.J. Navigation and Control Div.
DESIGN AND DEVELOPMENT OF AN INTEGRAL BRUSHLESS dc TORQUER-ENCODER Final Summary Report
Saul Malkiel 1 Mar. 1970 112 p refs
(Contract NAS8-24655)
(NASA-CR-102656; Rept-7511-70-R5; DRL-120) Avail: CFSTI CSCL 09E

Error sources in the torquer are located, procedures are developed to reduce the errors, and recommendations are made for designing an integral brushless torquer-encoder based on the Hall resolver principle. Author

N70-27509# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen/ZDBS.
DESIGN OF ANTENNAS FOR A FOLLOW-UP INTERFEROMETER SYSTEM OVER FREQUENCY RANGE 136 – 138 MHZ [ANTENNENENTWURF FUER EIN MACHFUEHRBARES INTERFEROMETERSYSTEM IM FREQUENZBEREICH 136 – 138 MHZ]
H. Oettl Jan. 1970 31 p refs In GERMAN; ENGLISH summary
(Contract RFF-4036)
(BMBW-FB-W-70-03) Avail: CFSTI

The DFVLR is planning an interferometer system with three mechanically direction-controlled antennas which will be located near Lichtenau/Weilheim. The antennas of the system were designed to given specifications and electrical and mechanical tolerances were taken into account. The results are discussed. Author (ESRO)

N70-27558# Bonnyo Univ. (West Germany). Physikalisches Inst.
ELECTRONICS OF A ROCKET-BORNE MASS SPECTROMETER WITH HELIUM-COOLED ION SOURCE [DIE ELEKTRONIK EINES RAKETENGETRAGENEN MASSENSPEKTROMETERS MIT HELIUMGEKUEHLTER IONENQUELLE]
W. Scheichl and D. Offermann Jan. 1970 71 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-70-01) Avail: CFSTI

The electronic components for a rocket-borne monopole spectrometer are described. Its ion source was cooled to 6 deg K with helium to suppress reflection of gas particles from the ion source walls. Circuits for operation of the ion source (emission regulator and voltage divider), analyzing field (rf oscillator and regulator), detection systems (electrometers and their in-flight calibration), and the cryogenic system (temperature and pressure sensors) are presented. In addition, the test console for the operation and control of the spectrometer before the flight is outlined. Author (ESRO)

N70-27565# European Space Research and Technology Center, Noordwijk (Netherlands).
AN ELECTRONIC SPIN-ANGLE CLOCK FOR A SPIN-STABILIZED SATELLITE
J. De Waard and H. J. N. Spruijt Aug. 1969 30 p
(ESRO-TN-98-(ESTEC)) Avail: CFSTI

An electronic spin-angle clock has been developed. It generates logic pulses very accurately at programmed spin angles. The clock can also be used to measure angles and times with respect to the satellite's datum meridian pulse. During eclipse the clock operates in a programmable decoding mode, generating pulses related to a known constant pseudo spin rate. With somewhat more complex circuitry, a 'flywheel' mode of operation can be selected, in which pulses are generated in phase with those generated under sunlight conditions, it being assumed that the spin rate remains constant during eclipse. The system's stability has been computed. The equation for the angular error at any step interval is presented, as are the results of computer calculations on the maximum possible angular error over certain spin rate intervals. Author (ESRO)

N70-27589*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
A COMPUTERIZED ONBOARD EXPEDITIOUS MONITOR AND MAINTENANCE ANALYST (EMMA) FOR SPACECRAFT SYSTEMS
Willard W. Anderson, Ralph W. Will, and Kenneth L. Jacobs Washington May 1970 39 p refs
(NASA-TN-D-5725) Avail: CFSTI CSCL 09E

A computerized monitor and maintenance system for automatic spacecraft system fault isolation and repair is defined. Rationale for the requirement of such a system and general criteria for the synthesis of such a system are presented. A simulation of the maintenance system in operation onboard a space station using a CDC 6600 computer programmed to operate in real time and linked to a full-scale prototype control moment gyro (CMG) attitude control system is described. A discussion of the performance of the simulated maintenance system and its ability to diagnose correctly and repair CMG system failures is included. Author

N70-27743 National Lending Library for Science and Technology, Boston Spa (England).
DETERMINATION OF THE PARAMETERS OF INTRINSICALLY SAFE CIRCUITS FOR VOLTAGES UP TO 220 [OPREDELENIE PARAMETROV ISKROBEZOPASNYKH SISTEM NAPRYAZHENIEM DO 220 V]
Dec. 1965 13 p Transl. into ENGLISH from Tekhnika Bezopasnosti V Neftyanoi Promyshlennosti (Moscow), 1966 p 113 120
(NLL-SMRE-Trans-5735-(8313.4)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Circuit safety standards for equipment used in oil extraction and oil and gas processing were determined. A curve was derived which denotes the dependence of the igniting current on voltage, and the probability of ignition was found. Inductive and capacitive circuits were studied in an explosion chamber with vapor-air mixtures, and inductors with air and with steel cores were considered. N.E.N.

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N70-26664# California Univ., Los Angeles.
ON NON-BLOCKING SWITCHING NETWORKS
David G. Cantor [1969] 18 p refs Sponsored in part by Sloan Found.
(Grant NSF GP-13164)
Avail: Issuing Activity

A switching network may be informally described as a collection of single-pole, single-throw switches arranged so as to connect a set of terminals called inputs to another set of terminals called outputs. It is nonblocking if, given any set of connections from some of the inputs to some of the outputs, and an idle input terminal x and idle output terminal y, then it is possible to connect x to y without disturbing any of the existing connections. Denote by sigma(a,b) the minimal number of switches necessary to connect a inputs to b outputs using a nonblocking network. The growth of sigma(a,a) as a approaches infinity is given. Author

N70-26696# Akademiya Nauk URSR, Kiev.
DETERMINING THE AMPLITUDE AND FREQUENCY IN A THREE-NETWORK RC GENERATOR
V. P. Bodunov *In its* Appl. Acoustics and Vibration Technol. 1968 p 143-153 refs In RUSSIAN (se N70-26676 13-34)
Avail: CFSTI

When studying nonlinear systems of an order greater than two, the method of equivalent linearization is usually used. This method permits finding the amplitude and steady-state oscillations. The perturbation method is also used, which permits computation of the harmonic content and amplitude in the steady state. In the course of developing equipment subassemblies in which RC generators are used, the results obtained with the attraction of the method of slowly varying coefficients (calculating the amplitude and frequency, frequency correction, etc.) are of interest. An analysis is presented for a three-network RC generator with the resistors connected in parallel. Transl. by H.W.

N70-26725# Naval Postgraduate School, Monterey, Calif.
SENSITIVITY ANALYSIS OF FEEDBACK CONTROL SYSTEMS
Windall Ray Knight (M.S. Thesis) Dec. 1969 73 p refs
(AD-700708) Avail: CFSTI CSCL 12/1

A technique for the use of a digital computer for simultaneous generation of feedback control system transient response and sensitivity to parameter variations is developed. The sensitivity model for a basic linear control system is a cascaded replica of the original system with the sensitivity pickoff points corresponding to the error and feedback signals of the original system. This is convenient for computer analysis with DSL/360. For systems with nonlinear elements, the sensitivity model is implemented by making the instantaneous gain equal to the slope of the nonlinear function. Sensitivity analysis is utilized for improvement of system performance, determining parameter tolerances, and predicting changes in the response due to parameter variations. Author (TAB)

N70-26847# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REALIZING THE FUNCTIONS OF LOGIC ALGEBRA IN ONE CLASS OF CIRCUITS MADE ON FUNCTIONAL AND SWITCHING ELEMENTS
S. S. Kravtsov 2 Oct. 1969 19 p refs Transl. into ENGLISH from Probl. Kibernetiki (Moscow), no. 19, 1967 p 285-292
(AD-700293; FTD-MT-24-207-69) Avail: CFSTI CSCL 9/2

The problem of determining the order of growth of the Shannon function as well as the complexity of realizing functions of logic algebra using plane, rectangular circuits is discussed. Four lemmas are proposed and proven. Author (TAB)

N70-26959*# Bellcomm, Inc., Washington, D.C.
TIME TO CYCLE SLIP IN FIRST AND SECOND ORDER PHASE LOCK LOOPS
L. Schuchman 19 Dec. 1969 50 p refs
(Contract NASw-417)
(NASA-CR-109760; TM-69-2034-8) Avail: CFSTI CSCL 09C

A recursive differential equation for the nth moment of the time-to-cycle slip parameter is derived for both the first and second order phase lock loop. Explicit results are presented for the first four moments. While the moments obtained in a second order loop are approximately correct, the solutions for the first order loop are exact. The approach taken in deriving results for the first order loop, was to demonstrate that the phase error in the loop is a Markov process so that its transitional frequency function satisfies the Chapman - Kolmogorov equation. Then starting with the Chapman - Kolmogorov equation, a differential equation is derived which the transitional frequency function satisfies. Author

N70-26998*# Bellcomm, Inc., Washington, D.C.
CHARACTERIZING THE BEHAVIOR OF PHASE LOCK LOOPS
L. Schuchman 20 Feb. 1970 11 p refs
(Contract NASw-417)
(NASA-CR-109762; TM-70-2034-2) Avail: CFSTI CSCL 09C

The order of a phase lock loop is determined by the linear filter in the loop. A phase lock loop is of n+1 order when there are n finite poles in the Laplace transfer function of its linear filter under the restriction that the number of zeros of this Laplace transform is no greater than n. In a previous memorandum the behavior of a first and a particular second order phase lock loop was described in terms of the statistical behavior of two parameters, namely, the steady state phase error and the time to cycle slip. This memorandum generalizes the work just described in that the statistical behavior of the steady state phase error and the time to cycle slip is characterized for a very large class of nth order phase lock loops. It is to be noted that the procedure developed in this memo can be used to characterize the behavior of several other nonlinear devices as, for example, the delay lock loop. Author

N70-27112 National Lending Library for Science and Technology, Boston Spa (England).
EQUATIONS FOR THE ELEMENTS CONTROLLING THE EXCITATION OF SYNCHRONOUS GENERATORS FOR CALCULATION BY THE ETsVM COMPUTER [URAVNENIYA REGULATOROV VOZBUZHDENIYA SINKHRONNYKH GENERATOROV DLYA RASCHETA NA ETsVM]
V. F. Chesachenko Feb. 1970 14 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 10, 1968 p 85-88
(NLL-RTS-5576) Avail: Natl. Lending Library, Boston Spa, Engl.: 10s or 1 NLL photocopy coupons

The dynamic stability of control systems is formulated, considering signal transmission and the parameters of each element of the control system. Assumptions made in the structure of the controller are: (1) the grid control of the thermionic valve of the exciter follows the cosine law, (2) a stable linear relation between the incoming and outgoing signals, (3) equivalent time constant of the integrating amplifier can be disregarded, and (4) the dynamic characteristics of the frequency control transmitter are not considered. Starting with the development of equations for the differentiating elements, the equations for the differentiating circuit suitable for the computer (ETsVM) are obtained, and the mathematical model of the controller derived. The calculations show that the effect of speedy extinction of the oscillations is gained with the stabilization of frequency and voltage. F.O.S.

N70-27209# Sandia Corp., Albuquerque, N. Mex.
PROGRAM WINNOW (PROGRAMMER'S MANUAL), PART 2
Lewis A. Faw Jan. 1970 137 p refs

(SC-M-69-401-A-Pt-2) Avail: CFSTI

Program WINNOW is a computer program for editing, checking, and correcting data which represent a printed circuit board. It edits input, checks all circuitry for specified clearances, and makes corrections necessary for good connections of circuitry elements. The input to WINNOW is digitized data prepared for the Gerber NC drafting machine. The output from WINNOW consists of : (1) corrected data for the Gerber (magnetic tape or cards), (2) a drawing which relates x and y coordinate data to drill holes and terminals (lands), and (3) an S-C 4020 plot of the board overlaid with a coordinate grid for checking purposes. Program WINNOW is written for the CDC-3600 computer and for the UNIVAC 1108 computer. The 1108 program has two versions: a standard version which will handle the data for a board containing about 800 terminals, and a segmented version for about 1400 terminals. Author

N70-27386*# Colorado Univ., Boulder.

FREQUENCY RESPONSE APPROACH TO DESIGN OF ADAPTIVE CONTROL SYSTEMS VIA MODEL OF SPECIFICATIONS

Ned Tetsuyoshi Oda 1 Aug. 1969 82 p refs

(Grant NGR-06-003-083)

(NASA-CR-106209) Avail: CFSTI CSCL 09C

A method of translating time domain specifications to frequency domain specifications via specification modeling is presented. The technique entails finding model time functions which bound the desired time domain specifications, taking the Laplace transform of the known functions, and then using these transforms (transfer functions) as boundary specifications in the frequency domain. The investigation and results of using this method on a second-order plant with varying parameters is shown. Author

N70-27552# Technische Hogeschool, Delft (Netherlands). Dept. of Aircraft Engineering.

METHOD FOR CALCULATING THE OPTIMAL FEEDBACK FOR A CONSTANT, LINEAR, DYNAMIC SYSTEM WHERE NOT ALL VARIABLES OF STATE MAY BE FED BACK [EEN METHODE VOOR DE BEREKENING VAN DE OPTIMALE TERUGKOPPELING VOOR EEN CONSTANT, LINEAIR, DYNAMISCH SYSTEEM, WAARVAN NIET ALLE TOESTANDSGROOTHEDEN TERUGKOPPELBAAR ZUN]

P. Ph. van den Broek Mar. 1967 52 p refs In DUTCH

(VTH-143) Avail: CFSTI

Equations are derived, which should be satisfied by the optimal feedback of a dynamic system. The system is described by n linear constant differential equations, each of which only contains one time derivative. If the feedback factors have been chosen such that the integral of a positive definite quadratic function of the variables of state and the input variables is minimal, then the feedback is optimal. The equations cannot be solved in closed form. Therefore, two methods are described approximating the solution in an iterative manner. The calculation methods are explained by using as an example the optimal feedback of a rocket plane (X-15). ESRO

N70-27655# Erlangen Univ. (West Germany). Technische Fakultaet.

NEW REALIZATION OF ELECTRICAL N-PORT NETWORKS [NEUARTIGE VERWIRKLICHUNG VON ELEKTRISCHEN N-TOREN]

Eberhard Kienzle (Ph.D. Thesis) 1969 156 p refs In GERMAN

Avail: CFSTI

New network synthesis methods for realizing n-ports are given based on the impedance matrix and leading to canonic circuits (Tellegen) are described. In a certain case they are all n-port extensions of the two-port circuits of Brune and of Unbehauen. The fundamentals and the matrix algebra and network theory rates rules are described and the synthesis methods, including all matrix transforms mainly used for creating equivalent circuits are discussed. ESRO

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N70-26606# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton.

AN EXERCISE IN COMPUTER ASSISTED CONTROL USING AN ION SOURCE

D. David and P. F. Jones Feb. 1969 11 p

(RHEL/R-179) Avail: AEC Depository Libraries

An account is given of the computer program development for assisted control of accelerator equipment. Lessons have been learned which will be valuable in designing a system for the computer-assisted operation of a new extracted proton beam at Nimrod. Author (NSA)

N70-26613# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimental'noi Fiziki.

A LINEAR ION ACCELERATOR WITH SPATIAL HOMOGENEOUS STRONG FOCUSING

I. M. Kapchinskii and V. A. Teplyakov 1969 16 p refs In RUSSIAN

(ITEF-673) Avail: AEC Depository Libraries

A linear ion accelerator with high using and acceleration is proposed. The high frequency electric field is formed by a four-conductor line. There are no drift tubes in the accelerator. The advantages of the proposed accelerator are relatively simple equipment, small transverse sizes, and a possibility to lower the injection energy while keeping the intensity of the accelerated beam on the high level. Author (NSA)

N70-26614# California Univ., Berkeley. Lawrence Radiation Lab.

SHIELDING MEASUREMENT AT THE CERN 25-GeV PROTON SYNCHROTRON

W. S. Gilbert 20 Oct. 1969 21 p refs Held at the Intern. Conf. on Accelerator Dosimetry and Experience, Stanford, Calif.

(Contract W-7405-eng-48)

(UCRL-19367;CONF-691101-11) Avail: CFSTI

An outline is presented on shielding measurements at the CERN synchrotron using 14.6 and 26.4 GeV/c protons. NSA

N70-26622# California Univ., Berkeley. Lawrence Radiation Lab.

SURVEY OF EXTERNAL INJECTION SYSTEMS FOR CYCLOTRONS

D. J. Clark Oct. 1969 39 p refs Presented at the Intern. Cyclotron Conf., Oxford, England

(Contract W-7405-eng-48)

(UCRL-18980; CONF-690921-2) Avail: CFSTI

To make heavy ions with the high charge states necessary for high cyclotron energy, the ion source needs high arc power input, which is supplied more easily in an external source. For negative ion acceleration, high gas flow and low pressure are needed, indicating the advantage of an external source. For polarized beams a few installations have used neutral beam injection. However, most polarized beam systems and all heavy ion and negative ion systems use ion injection because of beam control during transport, and no loss of beam in charge exchange. The ion beams are brought in either axially through the magnet pole, or radially along the median plane. The larger cyclotrons being planned for 200 - 500 MeV provide adequate space in the usually crowded center region, for transport and inflection of beams from external

injection systems. The various external injection systems operating or under construction for cyclotrons up to 550 MeV are compared and summarized. Author (NSA)

N70-26634# California Univ., Berkeley. Lawrence Radiation Lab.
RADIATION MEASUREMENTS AND SHIELDING STUDY OF THE BERKELEY 27-INCH HE-3 CYCLOTRON
Joseph B. McCaslin and Alan R. Smith Oct. 1969 13 p refs Held at the 2nd Intern. Conf. on Accelerator Dosimetry and Experience, Stanford, Calif.
(Contract W-7405-eng-48)
(UCRL-19374) Avail: CFSTI

The 27 inch He-3 cyclotron was designed and constructed at LRL Berkeley for use mainly in isotope production and activation analysis. Beam particle energy is 6 MeV/nucleon. Activation detectors and nuclear emulsions were exposed to secondary radiations produced by an internal beam of approximately 1 microangstrom striking a thick copper target. Moderated indium foils, the reactions Al-27(neutron, alpha)Na-24, F-19(neutron, 2 neutron)F-18, and C-12(neutron, 2 neutron)C-11, and emulsions provided the information on neutron yield and spectral shape at this beam intensity from which shielding estimates were made for full beam intensity operation of approximately 40 microangstroms. The radiation levels, detector techniques, and shielding computations are discussed. Author (NSA)

N70-26652# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton.
PULSED MAGNET COMMAND SYSTEMS
R. T. Elliott Feb. 1969 36 p refs
(RHEL/R-177) Avail: AEC Depository Libraries

The command, or trigger, systems of pulsed magnets in separated particle beams at the Rutherford High Energy Laboratory constitute a large fraction of the complete magnet assemblies. Equipment in current use on magnets performing three distinct functions is described and illustrated, and future development is discussed in relation to present ideas. Author (NSA)

N70-26655# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton.
NIMROD OPERATION AND DEVELOPMENT Quarterly Report, 1 Jan. -31 Mar. 1969
D. E. Gray, ed. May 1969 16 p
(RHEL/R-181) Avail: AEC Depository Libraries

The Nimrod beam was on for high energy physics research for 88.76% of scheduled operating time. Two experiments were completed and thirteen continued through in this quarter. The dc power supplies used with beam line elements in Nimrod's experimental halls are reviewed. Author (NSA)

N70-26669# Centro Informazioni Studi Esperienze, Milan (Italy).
PROJECT OF A 8-MeV TANDEM VAN DE GRAAFF, PART 1: THE ELECTROSTATIC GENERATOR
E. Caruso and M. Milazzo Oct. 1969 49 p refs
(CISE-N-130) Avail: AEC Depository Libraries

The design of a voltage generator for a tandem Van de Graaff accelerator for accelerating protons and deuterons at 1 to 10 MeV is discussed. Topics include pressure vessel, the stacks of equipotential plates, high voltage electrode, the insulators, short-circuit bar and capacitive pick-up, electrical charging, instrumentation of the electrostatic generator, generator voltmeter, gas handling, and preliminary results. NSA

N70-26813*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
KINESTHETIC CONTROL SIMULATOR Patent Application
Paul R. Hill and David F. Thomas, Jr., inventors (to NASA) Filed 20 Apr. 1970 15 p
(NASA-Case-LAR-10276-1; US-Patent-Appl-SN-29979) Avail: CFSTI CSCL 14B

A control simulator for permitting an operator to obtain experience in multiple degree freedom of movement of a vehicle similar to a lunar flying platform is described. The kinesthetic control simulator has a flat base upon which rests a support structure having a lower spherical surface for rotation on the base plate with columns which support a platform above the support structure at a desired location with respect to the center-of-curvature of the spherical surface. A handrail is located at approximately the elevation of the hips of the operator above the platform with a tilt ring attached to the support structure which may be used to limit the angle of tilt. Five degree freedom of rotation can be obtained by utilizing an air pad structure or dolly for support of the control simulator. NASA

N70-26941# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POSSIBILITY OF USING AN IRIS WAVEGUIDE AS AN ACCELERATING SECTION IN A PROTON SYNCHROTRON
E. R. Aleshin et al 3 Oct. 1969 15 p refs Transl. into ENGLISH from the Russian
(AD-700389; FTD-MT-24-182-69) Avail: CFSTI CSCL 20/7

Typical operating characteristics of a waveguide with diaphragms used in a synchrophasotron are calculated for injection energies from 6 to 16 Gev. Author (TAB)

N70-26969# Atomic Energy Commission Research Establishment, Riso (Denmark). Research Establishment.
[RESEARCH ACTIVITIES] Annual Report, 1 Apr. 1968 -31 Mar. 1969
Oct. 1969 65 p refs
(NP-18042) Avail: AEC Depository Libraries

Activities of the Danish Atomic Energy Commission and the Riaö research establishment for the period April 1, 1968, to March 31, 1969, are summarized. The operations of the various facilities at the research establishment are reviewed. Operating staff levels and financial data are tabulated, selected publications are listed, and design data on the research facilities are presented. NSA

N70-26977# Naval Research Lab., Washington, D.C.
VERTICAL DROP-WEIGHT MACHINE FOR CONDUCTING DROP-WEIGHT NDT, DROP-WEIGHT TEAR, AND DYNAMIC TEAR TESTS Final Report
L. A. Cooley and E. A. Lange 16 Jan. 1970 17 p refs
(AD-700934; NRL-6993) Avail: CFSTI CSCL 14/2

Methods for determining the fracture resistance of steels using the Drop-Weight Nil-Ductility Transition (DWT-NDT) Test, the Drop-Weight Tear Test (DWTT), and the 5/8-in. Dynamic Tear (DT) test, all by the use of a single vertical impact machine, are described. A vertical impact machine is useful when a limited number of tests are to be conducted, and when cost is an important aspect for determining equipment type. The machine described is of 2000 ft-lb capacity, and two methods for the determination of dynamic tear energy are described. One method employs an oscilloscope trace of the hammer load during the fracture process, and the other method uses the residual kinetic energy of the hammer to compress lead bars. A vertical impact machine is the standard tool (ASTM Standard E208) for conducting the DWT-NDT, and it can be readily modified to conduct the DWTT and the 5/8-in. DT tests. Author (TAB)

N70-27081# Colorado Univ., Boulder. Dept. of Geological Sciences.
DEVELOPMENT OF A TRIAXIAL MACHINE FOR EXPERIMENTAL STUDIES OF ROCK DEFORMATION Final Report, 2 Oct. 1968 – 15 Dec. 1969

William A. Braddock 30 Dec. 1969 18 p refs
(Contract F19628-69-C-0093)
(AD-701419; AFCRL-70-0003) Avail: CFSTI CSCL 14/2

A triaxial testing machine has been constructed and partially tested. The machine will be used to study the mechanical properties of rocks under the following experimental conditions: Temperature: 0-500 degrees C: Confining pressures: 0-30,000 psi: Differential axial stress: 0-100,000 psi: strain rates .0001, .000001, .0000001, and .00000001/sec. Author (TAB)

N70-27110*# Texas A&M Univ., College Station. Aerospace Engineering Dept.
THE PULSED AIR GUST GENERATOR Final Report
J. Bicknell, C. L. Hethcoat, II, and M. A. Guy [1969] 16 p ref
(Grant NGR-44-001-036)
(NASA-CR-66936) Avail: CFSTI CSCL 14B

A method of producing controlled gusts on a uniform airstream would simplify the experimental investigation of gust effects. Gusts normal to the stream vector have been produced by mechanically oscillated airfoils, but the maximum frequency is limited by the problem of oscillating large surfaces. A method of producing gusts by modulating air jets was proposed. A feasibility study made in the 2' × 3' wind tunnel led to the design and construction of a gust generator for the 7' × 10' wind tunnel. With a test section large enough for research above the troublesome Reynolds number effects, the facility would be a very useful research tool. Author

N70-27113*# Analytical Mechanics Associates, Inc., Palo Alto, Calif.
MOTION DRIVE SIGNALS FOR PILOTED FLIGHT SIMULATORS
Stanley F. Schmidt and Bjorn Conrad Washington NASA May 1970 84 p refs
(Contract NAS2-4869)
(NASA-CR-1601) Avail: CFSTI CSCL 14B

In order to use the limited motion capabilities of a simulator effectively it was necessary to (1) determine which motion cues are important to a pilot; (2) ascertain which cues are attainable within the drive system capabilities of a simulator; and (3) synthesize logic for commanding motion achievable by the drive system and realistic to a pilot. A mathematical approach to this problem is summarized, and logic synthesized for a motion generator is presented. Both the theory and the logic should be applicable to a wide variety of motion simulation problems. Author

N70-27136# Oak Ridge National Lab., Tenn.
TESTS OF THE LUWA BLAST VALVE
Conrad V. Chester 10 Dec. 1969 19 p Sponsored by AEC
(ORNL-TM-2796) Avail: CFSTI

Six-element modules of LUWA Blast Valves, Models BZS 64-2 and BZS 67-14, were given pressure drop and shock tests. The valves consist of a coplanar group of leaf springs in a cage assembly. The stiffness of the springs keeps the valve open against normal ventilating pressure drops but permits them to move against a seat, closing the valve, under shock loading. Closing time is in milliseconds, permitting very small volumes of high-pressure air to pass the valve; for both valve models this leakage was found to vary with reflected overpressure. Author

N70-27138*# Bellcomm, Inc., Washington, D.C.
ANALYSIS OF A TEST METHOD FOR MEASURING RESONANT FREQUENCIES OF LOADED HYDRAULIC FEED LINES
G. C. Reis 23 Jan. 1970 29 p ref
(Contract NASw-417)
(NASA-CR-109776; TM-70-1033-1) Avail: CFSTI CSCL 14B

This memorandum analyzes the MSFC facility for testing the resonant frequencies of fluid feed lines. A theoretical analysis of a simple model of the test facility is presented. This is followed by derivation of equations for a more complete model for computer simulation. The computer results, theoretical results and test results are in good agreement. Author

N70-27247# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Luftstrahlantriebe.
THE COMPRESSOR TEST RIGS OF THE INSTITUT FUER LUFTSTRAHLANTRIEBE OF THE DVL [DIE VERDICHTERPRUEFSTAENDE DES INSTITUTS FUER LUFTSTRAHLANTRIEBE DER DVL]
Bernhard Dittie and Klaus Oberdieck Oct. 1969 103 p refs In GERMAN; ENGLISH summary
(DLR-MITT-69-19) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 26, 30 DM

The design of the test compressor facilities of the Institut fur Luftstrahlantriebe of the DVL is described in detail. Using electric dc motors as prime movers, the test stands were intended for open cycle and closed cycle operation. For closed cycle operation, suitable vacuum pumps are available to vary the internal pressure in the cycle. The compressors to be tested are to be of transonic and supersonic type to operate at normal and elevated temperatures. The measuring and data acquisition facilities are also described. Author (ESRO)

N70-27335# Akademiya Nauk URSR, Kiev.
UNIT FOR THE EXPERIMENTAL STUDY OF THE HEAT CONDUCTIVITY OF SOLIDS IN THE 200 TO 1500 C TEMPERATURE RANGE
F. F. Lezhenin *In its* Heat Transfer in Power Eng. Units 1967 p 81-87 refs In RUSSIAN (See N70-27326 13-33)
Avail: CFSTI

A method is developed for determining experimentally the coefficient of heat conductivity of special construction materials in the 200 to 1500 C temperature range. The method is based on the absolute determination of heat conductivity in the stationary regime. For the experimental determination of heat conductivity of the solid under study and its temperature dependence, a special experimental unit was developed. The unit contains a vacuum apparatus with electrical and measurement circuits. Thermal conductivity temperature dependencies are studied for electrode graphite up to 1500 C and for VT-3 titanium alloy up to 1300 C. Transl. by H.W.

N70-27402# Royal Aircraft Establishment, Farnborough (England).
THE RAE NYLON ROPE CATAPULT
F. C. Bluett and J. C. H. Longrigg May 1969 31 p refs
(RAE-TR-69108) Copyright. Avail: CFSTI

This report describes the construction and the operation of a catapult capable of accelerating a test object such as a parachute or other deceleration device up to 350 ft/sec, through a distance up to 300 ft. The catapult consists of a 1000 ft long 3 inch circumference nylon rope placed in tension with one end connected to the test object. When the object is released the relaxation of the rope accelerates it rapidly up to the test speed, which is maintained for approximately 0.7 sec. Author (ESRO)

N70-27458# Royal Aircraft Establishment, Farnborough (England).
A RIG FOR THE STATIC-TESTING OF MODEL AIR-INTAKES
I. McGregor Nov. 1969 12 p *ref*
(RAE-TR-69251) Copyright. Avail: CFSTI

An extensive program of wind tunnel tests at transonic and supersonic speeds on fuselage-side intakes for strike-fighter aircraft is in progress at RAF Bedford. This report describes a simple rig that enables these intakes to be tested under static (i.e. ground running) conditions. Some results of tests on a typical

intake model are included, the main purpose of which was to determine the extent to which the intake environment needs to be represented in static tests of intakes of this type. Author (ESRO)

N70-27521# Princeton Univ., N.J. Plasma Physics Lab.
DIGITAL CONTROL OF A RESEARCH DEVICE
Ellis D. Simon, Steven P. Duritt, and M. Pelovitz Dec. 1969 11 p Presented at the Symp. on Eng. Problems of Controlled Thermonuclear Res., Los Alamos, N.Mex., May 1969
(Contract AT(30-1)-1238)
(MATT-726; CONF-690452-1) Avail: CFSTI

Operation of the FM-1 research device at the Plasma Physics Laboratory will require an entirely new control complex. This system will provide the functions of startup, shutdown, enable-disable and start-stop. In providing these functions the control system must be designed in such a way that failure will not cause a hazard to personnel or equipment. In operation, the FM-1 operator will use lighted push buttons in the console. Conditions that prevent the normal sequence of operation will be displayed on a storage scope. Field levels and timer settings can be set by a 10-button touch tone input. The normal operations log will be printed on the typewriter. Parameter settings will be punched on cards. Author (NSA)

N70-27541*# Grumman Aerospace Corp., Bethpage, N.Y.
HAZARD DETECTION METHODS FOR A LUNAR ROVING VEHICLE Final Report
J. Elefant, E. Lavan, and E. Veshlage Jan. 1970 83 p refs
(Contract NAS8-25098)
(NASA-CR-102510; DCN-1-X-40-94302-(IF)) Avail: CFSTI CSCL 13F

A system is investigated which is capable of detecting potential hazards to a lunar roving vehicle and preventing it from moving into a position which would disrupt the mission. Sensors or combinations of sensors were studied for radio frequency wave propagation above or through the lunar surface and seismic wave propagation through the lunar surface. Pulse and FM-CW radars were considered for a surface detection system and seismic techniques and soil penetrating radar were considered for a subsurface detection system. The physical and performance impact on LRV capability were determined from the sensor investiations. Author

N70-27544# Oak Ridge National Lab., Tenn.
CONCEPTUAL DESIGN OF ORMAK FACILITY
G. G. Kelley, M. Roberts, and J. F. Clarke Dec. 1969 24 p refs Presented at the Intern. Symp. on Closed Confinement Systems, Dubna, USSR, 29 Sep. - 3 Oct. 1969
(Contract W-7405-eng-26)
(ORNL-TM-2821; CONF-690931-3) Avail: CFSTI

The ORMAK facility is designed to make available a TOKAMAK-like plasma for basic studies leading toward an evaluation of the TOKAMAK approach to controlled thermonuclear fusion. Azimuthal symmetry and diagnostic access are achieved by producing the toroidal magnetic field with a single-turn coil uniformly fed from a toroidal transformer. Probable asymmetries in the poloidal and vertical magnetic field structures are avoided by taking special precautions in locating the current-carrying conductors. Through the use of high current joints it is possible, by changing the coil, to change the aspect ratio or the shape of the chamber. Author (NSA)

N70-27701# California Univ., Berkeley. Lawrence Radiation Lab.
HALON 1301 FIRE EXTINGUISHING SYSTEM FOR TRAILERS
J. R. Gaskill, E. C. Leonhart, and E. N. Sanborn 19 Aug. 1969 23 p refs Sponsored by AEC
(UCRL-50731) Avail: CFSTI

Factors in the selection of equipment and extinguishants for an automatic fire extinguishing system to be used in instrumentation trailers are discussed. The design of such a system for LRL trailers is described. This design includes automatic combustion detection, fault detection, and Halon 1301 extinguishant discharge. The results of system tests and suggestions for portable versatile packaging are given. The appendices give test data, actual layout, and design details. Author (NSA)

N70-27710# California Univ., Berkeley. Lawrence Radiation Lab.
THE BEVATRON
Nov. 1969 17 p refs
(TID-25321) Avail: CFSTI

The design and operation of the Bevatron are described as well as the experimental equipment and research carried on at the accelerator. A brief history of the Bevatron is presented, and fundamental operating parameters are listed. NSA

N70-27792# Atomic Power Development Associates, Inc., Detroit, Mich.
DESIGN, DEVELOPMENT, AND EVALUATION OF A CONTINUOUS FLOW SODIUM CENTRIFUGE
Joseph Matte, III and William L. Toth Dec. 1969 10 p refs
(Contract AT(11-1)-865)
(APDA-243) Avail: CFSTI

A program to build a centrifuge for sodium service and to determine its capabilities for continuous removal of particulate impurities from liquid sodium has been undertaken. This unit operates in an argon atmosphere within a spherical glove box. The centrifuge exerts a centrifugal force of 62,000 g at the bowl wall and can process sodium at 300 to 700 F. The centrifuge was connected to a branch of the Sodium Technology Loop. The quantity and type of impurities removed by the centrifuge were analyzed in the sodium chemistry laboratory. In the development of the centrifuge, unusual problems were encountered with bearings and seals capable of rotating at 50,000 rpm in an environment of inert gas. A considerable amount of testing was performed to develop a stabilizing bearing for the bottom of the bowl that had to operate where liquid or a mist of sodium would be present. Another problem was the development of a gas seal that would allow the use of an air turbine mounted external to the glove box, to drive the bowl within the box. An initial 20-hr test established the purification feasibility and capability. Author (NSA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N70-26559*# IIT Research Inst., Chicago, Ill.
RECIRCULATION PATTERNS IN THE INITIAL REGION OF COAXIAL JETS
Tzvi Rozenman and Herbert Weinstein Washington NASA May 1970 76 p refs
(Grant NGL-14-004-028)
(NASA-CR-1595; CH-E-9) Avail: CFSTI CSCL 20D

An experimental study is presented of the initial region in a turbulent coaxial jet flow. The initial region is the region of the flow upstream of the self-similar flow regime and is strongly influenced by inlet geometry and velocity profile. The investigation is limited to low speed coaxial jets which can be considered incompressible. The outer air stream velocity was held constant at 48 ft/sec and the inner velocity varied from 0 to 48 ft/sec, to give velocity ratios from infinity to one. The inner stream was either air or Freon 12 which has a density four times that of air. Experimental measurements were made with a hot wire anemometer system and static pressure probes. Shadow graph pictures were

taken to illustrate the flow patterns in the initial region. The data includes average velocity and turbulence intensity in the initial region, and center line and radial distribution of static pressure. The data shows that a back flow region is formed at outer to inner stream velocity ratio of 13 for the homogeneous jet and at outer to inner stream velocity ratio of 26 for the heterogeneous jet. For higher velocity ratio, a circulating toroidal vortex is established which enhances mixing between the inner and outer streams. This vortex pattern exhibits similarity of velocity with velocity ratio variation. Author

N70-26593 Dartmouth Coll., Hanover, N.H.
CAPILLARY FLOW OF SUPERFLUID HELIUM AT 0.45 K
Tak-Kin Chu (Ph.D. Thesis) 1969 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-21226

A gravitational flow technique has been used to study superfluid helium flow in glass capilaries, with diameters between 0.020 and 0.25 cm, and also with orifices in thin metal foil. The flow, which is initiated by a mechanical plunger, takes place between two concentric reservoirs, the inner one being a microwave resonant cavity. The resonant frequency changes linearly with the liquid level when the cavity is about half-filled with helium. A simple calibration allowed the cavity to be used as a sensitive liquid level detector. The experiments are done at 0.45 K. At this temperature, the effects of the normal fluid (mutual friction force, thermomechanical pressure, and viscosity) are small, so that the measured pressure difference at the ends of the capillaries can be attributed to a superfluid-boundary interaction force. It is found that the flow of superfluid in these experiments is essentially uniform over the cross-section of the capillaries. Dissert. Abstr.

N70-26732 Polytechnic Inst. of Brooklyn, N.Y.
DROP FORMATION IN IMMISCIBLE FLUIDS AT LOW VELOCITIES
Stephen Solomon (Ph.D. Thesis) 1969 171 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-20370

An attempt was made to produce a completely theoretical model that would accurately describe drop formation in immiscible fluids at low to medium dispersed phase velocities (up to 15–30 cm/sec). Drop formation is hypothesized to occur in two steps: first a single drop, the static drop, grows on the nozzle tip until it reaches a certain critical volume (the static drop stage). The drop then starts to split into two drops: the dynamic drop and the neck drop, which are still attached at this point. The dynamic drop accelerates and eventually detaches; the neck drop grows and after the dynamic drop detaches becomes the new static drop (the dynamic drop stage). The model for the static drop stage is partly based on experimental data, however these data are very precise and reproducible, and can be predicted from theory. The dynamic drop stage development is completely theoretical. Dissert. Abstr.

N70-26747# Tel-Aviv Univ. (Israel). Dept. of Environmental Sciences.
WALL TURBULENCE Final Report, 1 Oct. 1968–30 Sep. 1969
Gdalia Kleinstein 8 Oct. 1969 10 p refs
(Contract F61052-69-C-0018)
(AD-701091; AFOSR-70-0313TR) Avail: CFSTI CSCL 20/4

A theoretical investigation of the mean properties of a fully developed turbulent pipe flow was carried out. The analysis was divided into three phases: the wall region, the core region, and the matching procedure. In the wall region the generalized eddy viscosity of Kleinstein (AIAA Journal, Vol. 5, No. 8, 1967) was applied and led to good agreement with experimental data for velocity distribution, turbulent distribution and energy dissipation functions. In the core region an eddy viscosity model was derived and led to good agreement when compared with experimental data for velocity defect law. Energy dissipation functions in this region fall below the experimental data. The matching of the region resulted in a complete description of the flow field in a pipe and in particular led to a friction law. Author (TAB)

N70-26827# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CERTAIN PECULIARITY OF OVEREXPANSION OF SUPERSONIC FLOW IN A CYLINDRICAL PIPE
F. F. Tarasov 29 Sep. 1969 12 p refs Transl. into ENGLISH from Aviats Inst., Kazan. Tr. (USSR), no. 93, 1967 p 25–28
(AD-700790; FTD-MT-24-212-69) Avail: CFSTI CSCL 20/4

The results are given of experiments with supersonic airflow in a cylindrical pipe. The configuration and dimensions (in millimeters) of the pipe are shown: (1) the Laval nozzle; (2) a set of Hg manometers for measuring the static pressure; and (3) the pipe with asbestos insulation. The ultrasonic flow was generated by means of two vacuum pumps operating in parallel. The results of pressure measurements are shown. The distribution of the normalized (reatmospheric) pressure is shown with respect to the pipe length. The lower curve corresponds to the existence of supersonic flow in all parts of the pipe. The other curves correspond to the overexpansion of the flow with pseudo-jumps. The increase in the pressure in the region of pseudo-jumps measured during the experiments exceeded the theoretically predicted values. Author (TAB)

N70-26831# Aix-Marseilles Univ. (France). Inst. of Fluid Mechanics.
LINE REVERSAL METHOD TO MEASURE TEMPERATURES IN AN EXPANSION NOZZLE [APPLICATION DE LA METHODE DE RENVERSEMENT DES RAIES A LA MESURE DES TEMPERATURES DANS UNE TUYERE DE DETENTE]
J. C. Chaize (Ph.D. Thesis) 31 Oct. 1968 72 p refs In FRENCH
Avail: CFSTI

Theoretical and experimental results for the evolution of vibrational gas temperature are compared. Temperatures measured by line reversal from sodium in nozzle outflow and with back shock at a dihedral angle are used. Line reversal temperature measurements from chromium are also used for the study of hypersonic two dimensional nozzle flow. Transl. by J.M.C.

N70-26876# Clarkson Coll. of Technology, Potsdam, N.Y.
AN INVESTIGATION OF PULSATING TURBULENT FLOW Progress Report, 1 Jun. 1969 28 Feb. 1970
Richard J. Nunge and Fadel F. Erian 28 Feb. 1970 8 p
(Contract AT(30-1)-4102)
(NYO-4102-1) Avail: CFSTI

A combined experimental and theoretical study of the fluid dynamics of pulsating turbulent flow was undertaken to obtain an understanding of the governing mechanisms in transport processes taking place during pulsating turbulent flow and to determine the basic structure of this flow field. The designs of experimental facilities for basic gas and liquid flow systems without pulsations have been completed. The motor fan assembly and plenum chamber for the gas system have been constructed. NSA

N70-26884# IIT Research Inst., Chicago, Ill.
HYDRODYNAMIC STABILITY OF POISEUILLE FLOW IN A ROTATING PIPE Final Report, 1 Apr. 1968–1 Apr. 1969
J. Strohl and Z. Lavan Oct. 1969 105 p refs
(Contract F33615-67-C-1406)
(AD-701037; ARL-69-0174) Avail: CFSTI CSCL 20/4

The hydrodynamic stability of an incompressible Poiseville flow in a rotating pipe is studied. The analysis considers linear, viscid non-axisymmetric disturbances. For the case of a very large rotation, the range of axial wave numbers at which unstable modes may exist is determined, and a critical Reynolds number (based on

axial flow), 82.93 is found. The transition is stationary with respect to a co-ordinate system that rotates with the pipe, and it occurs at the fundamental mode of the tangential disturbance. In addition, Reynolds number as well as the axial and tangential wave numbers for some values of growth rate are determined and eigenfunctions for some of the cases considered are calculated. Author (TAB)

N70-26897# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
INVESTIGATION OF HIGH ALTITUDE FLIGHT ENVIRONMENTAL EFFECTS ON PURE FLUID AMPLIFIERS AND JET EDGE RESONATOR OSCILLATORS
M. P. Bland and W. J. Harris 9 May 1969 199 p refs
(Contract DAAG39-69-C-0014)
(AD-701194; H-055) Avail: CFSTI CSCL 13/7

Four fluid amplifiers, two bistables and two proportionals, were subjected to reduced atmospheric pressures of 14.7, 10, 6, 2, and 0.16 psia. A single jet edge resonator oscillator was tested at the above pressures at each of the following temperatures: 72, 210, 350, and 500F. The report describes the results of these tests. Author (TAB)

N70-26905 Purdue Univ., Lafayette, Ind.
EXPERIMENTAL INVESTIGATION AND MODELLING OF THE HYDRAULIC VORTEX AMPLIFIER
Yasar Turhan Hondur (Ph.D. Thesis) 1968 182 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-7459

Steady state performance characteristics of the basic vortex valve were experimentally investigated. A set of variables to describe these characteristics adequately were formulated. A type of mathematical model was proposed in which the dependent variable is one of the performance variables. The significant dimensions of the valve were formed into dimensionless ratios. These dimensionless ratios are the independent variables in the mathematical model. The ranges of the dimensionless ratios were defined, and the valves corresponding to all the possible combinations of the dimensionless ratios were determined. A sample was carefully selected from all the possible valves, and these were tested at the supply pressure levels of 200 psi, 400 psi, and 600 psi. The tests were carried out for both the single and double exit orifice operation of the valve. Dissert. Abstr.

N70-26994# Los Alamos Scientific Lab., N. Mex.
STIFF: COMPUTER PROGRAM FOR THE SOLUTION OF STEADY, TURBULENT, INCOMPRESSIBLE FLUID FLOWS IN TWO DIMENSIONS
Stephen E. Ziemniak 2 Jan. 1970 19 p refs
(Contract W-7405-eng-36)
(LA-4322) Avail: CFSTI

The transport equations for vorticity, stream function, turbulent kinetic energy, and turbulence decay rate are solved numerically using an explicit finite differencing method. Author

N70-27005*# IIT Research Inst., Chicago, Ill.
TURBULENT MIXING IN THE INITIAL REGION OF HETEROGENEOUS AXISYMMETRIC COAXIAL CONFINED JETS
Kirti N. Ghia, T. Paul Torda, and Zalman Lavan Washington NASA May 1970 90 p refs
(Grant NGR-14-004-008)
(NASA-CR-1615) Avail: CFSTI CSCL 20D

Confined turbulent mixing of dissimilar circular jets is studied in the initial region. A binary isothermal system of non-reacting gases is considered. The central jet consists of a low-velocity high-density stream, while the coflowing annular stream is a high-velocity light gas. This system is characteristic of a gas-core nuclear reactor where minimum mixing is desired. The turbulent boundary layer equations are used to describe the confined jet mixing problem and the numerical solution is obtained by an explicit finite difference scheme. Results were obtained for four jet mixing configurations for which experimental data were available. Thus, correlation of the analysis with experiment is provided for a range of velocity ratio from 4.9 to 13.8 and density ratio from 1 to 4.2. A formulation is presented for the eddy viscosity and the eddy diffusivity that adequately describes the confined turbulent mixing of heterogeneous streams in the initial region. The empirical parameters used in the eddy viscosity expression are presented in terms of the mass flux ratio and their relation with the corresponding parameter for homogeneous free jet mixing is interpreted. It is shown that for confined heterogeneous mixing, the kinematic eddy viscosity is a function of both space coordinates r and z. However, the dynamic eddy viscosity is found to be a very weak function of the transverse coordinate, so that the dynamic eddy viscosity may be considered to vary only with the axial coordinate z. Author

N70-27074*# Alabama Univ., University
TWO PHASE FLOW AND HEAT TRANSFER IN POROUS BEDS UNDER VARIABLE BODY FORCES, PART 3 Final Report
James V. French, Jr. and Harold R. Henry Nov. 1969 129 p refs
(Contract NAS8-21143)
(NASA-CR-102667; Rept-113-30-Pt-3) Avail: CFSTI CSCL 20D

Techniques of computational fluid mechanics are proposed for a flow situation in which three fluid effects interact: viscosity, inertia, and surface tension. A flow in which a series of gas bubbles moves along the centerline of a tube of flowing viscous liquid is considered. The cross sectional area of the tube changes in a smooth periodic fashion with distance along the centerline. The liquid is Newtonian and the bubble surface exhibits surface tension. Author

N70-27097 National Lending Library for Science and Technology, Boston Spa (England).
THE INJECTION OF TURBULENT JETS INTO A FLUIDIZED BED
N. A. Shakhova 28 Nov. 1969 15 p refs Transl. into ENGLISH from Engr. Phys. J., v. 14, no. 1, Jan. 1968 p 61
(NLL-M-7948-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

On the basis of a hypothesis of the existence of two regions of a boundary layer, an approximate solution of the problem of injection of turbulent jets into a fluidized bed is set up. Experimental research was carried out which confirmed the correctness of the chosen model. Author

N70-27166*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
TRANSONIC FLOW IN A CONVERGING-DIVERGING NOZZLE Final Report
R. J. Prozan [1970] 78 p ref
(Contract NAS7-743)
(NASA-CR-109852; LMSC/HREC-D162177; HREC-7743-1) Avail: CFSTI CSCL 20D

Eight cases were analyzed and the results are presented. These contours had steep inlets (75, 90 degrees) and very small nozzle wall radius of curvature to throat radius ratios (0.5, 0.25). The finite difference techniques used in the analysis performed very well, particularly when the severity of the contours is considered. The theoretical approach to the finite difference solution is discussed. The computer program is considered to be extremely flexible, permitting several modes of operations for boundary conditions and grid structures. Many program control options are available for efficient utilization. Author

N70-27176*# Ohio State Univ., Columbus. Dept. of Aeronautical and Astronautical Engineering.
RADIATIVE TRANSFER, CHEMICAL NONEQUILIBRIUM, AND TWO-TEMPERATURE EFFECTS BEHIND A REFLECTED SHOCK WAVE IN NITROGEN
Leland Arnold Carlson (Ph.D. Thesis) 1969 159 p refs
(Grant NGR-36-008-106)
(NASA-CR-107942) Avail: CFSTI CSCL 20D

Investigation and analysis of the nonequilibrium phenomena for the case of the reflected shock wave were undertaken for the purpose of: (1) developing a solution to the reflected shock problem including chemical nonequilibrium and two temperature effects; (2) gaining a better understanding of the chemical processes in and their effect on the structure of the reflected shock flow field; and (3) determining the extent of thermal nonequilibrium behind a reflected shock wave and its relative effect on the end wall radiative heat transfer. Fundamental equations and boundary conditions governing the flow between a reflected shock wave and an end wall have been formulated including chemical nonequilibrium, two temperature, and radiative gas dynamic coupling effects. The resulting equations have been transformed into a boundary layer type of coordinate system, and a solution technique based upon a forward in time finite difference scheme has been postulated. A calculation has been carried out for a reflected shock wave resulting from an incident shock traveling at 11 km/sec into quiescent nitrogen at a pressure of 0.001 cm of mercury. A.L.

N70-27185*# Hydronautics, Inc., Laurel, Md.
AN INVESTIGATION OF TANDEM ROW HIGH HEAD PUMP INDUCERS Interim Report
Robert J. Etter and C. C. Hsu Feb. 1970 134 p refs
(Contract NAS8-20625)
(NASA-CR-109724; TR-703-8) Avail: CFSTI CSCL 20D

Supercavitating cascades having cambers other than constant pressure are studied theoretically and the results compared to existing experimental data. The "five term" cambered shape is shown to be particularly suited to first stage inducer application. The performance of partially cavitating cascades is also formulated and the necessary expressions are presented to calculate the significant performance parameters. A study of the three-dimensional velocity field generated by a radial vortex filament in a cylindrical annulus is presented. This study provides the basic data required to use the second stage design technique for a larger range of hub/diameter ratios than previously available. Using the vortex filament study, refinements in second stage interference streamline calculations are developed. Finally a first stage inducer design is presented utilizing the five term cambered shape and a 0.60 hub/diameter ratio. A matching second stage having a 0.70 hub/diameter ratio is also designed and presented. Author

N70-27295*# Brown Engineering Co., Inc., Huntsville, Ala. Space and Military Systems Div.
SHOCK PROPAGATION IN A TARGET SUBJECTED TO HYPERVELOCITY IMPACT ON AN INCIDENT PROJECTILE
T. Fu Apr. 1970 68 p refs *Its* Tech. Note SE-289
(Contract NAS8-20166)
(NASA-CR-102655) Avail: CFSTI CSCL 20D

A hydrodynamic model, based on shock diffraction theory and the quasi-similarity solutions of blast wave theory, is developed to describe the shock profile history in a metal target on which a hypervelocity metal projectile impacts. A finite difference integration of the resultant method of characteristic solution is used to obtain numerical results. A numerical example of aluminum impacting on aluminum at a velocity of 20 km/sec is presented. The comparison with the direct numerical results shows a good agreement for the case selected. Author

N70-27297*# Techtran Corp., Glen Burnie, Md.
A PLANE HYPERSONIC GAS STREAM [PLOSKAYA GIPERZVUKOVAYA STRUYA GAZA]
M. I. Folle Washington NASA Feb. 1970 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. Zhidkosti i Gaza (USSR), no. 4, Jul. - Aug. 1969 p 66 - 72
(Contract NASw-1695)
(NASA-TT-F-12796) Avail: CFSTI CSCL 20D

The flow of a plane hypersonic stream is examined in a medium at rest. The flow properties are investigated up to the formation of suspended shock waves. Author

N70-27317*# Translation Consultants, Ltd., Arlington, Va.
INVESTIGATION OF THE INTERACTION OF A SPHERICAL SHOCK WAVE WITH BODIES [ISSLEDOVANIYE VZAIMODEYSTVIYA SFERICHESKOY UDARNOY VOLNY S TELAMI]
A. N. Ivanov et al Washington NASA Apr. 1970 10 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Techn. Fiz. (Moscow), no. 6, 1969 p 115 - 119
(Contract NASw-2038)
(NASA-TT-F-12967) Avail: CFSTI CSCL 20D

The interaction of a spherical explosion wave featured by significant unsteadiness of the flow behind the shock wave was reviewed. The pulse force (the integral of the force in terms of time) communicated by the explosion wave to a stationary cylindrical body was measured, and the formation of the picture of the flow near a blunt flying body was investigated. Author

N70-27333# Akademiya Nauk URSR, Kiev.
HYDRAULIC RESISTANCE OF THE AIR COOLING SYSTEM OF A GAS TURBINE ROTOR
S. Z. Kopelev and S. V. Gurov *In its* Heat Transfer in Power Eng. Units 1967 p 57 - 70 refs In RUSSIAN (See N70-27326 13-33)
Avail: CFSTI

The purpose was to experimentally determine the rate-of-discharge characteristics, coolant air leakage, and hydraulic resistance coefficients of an air cooling system for an experimental high temperature gas turbine rotor over a wide range of Reynolds number changes. The agreement of the calculated and experimental data is ssatisfactory, and it is found that the rate-of-discharge characteristics of the system may be practically computed based on static blowing. Transl. by H.W.

N70-27371# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
TURBULENCE ANALYSIS PROGRAM (TURBAN1)
Robert W. Browell and Benny L. Crass 16 Jan. 1970 44 p refs
(Contract W-7405-eng-26)
(CTC-24) Avail: CFSTI

A FORTRAN coded program developed to provide computational assistance for the study of turbulence phenomena in research compressor systems is described. Specifically, the program computes turbulence intensity, turbulence components and Reynolds' stresses using data obtained from hot-wire anemometer measurements. The data input is in the form of punched cards. The program is in FORTRAN 4 for the IBM 360/65 computer. Author (NSA)

N70-27390# Commisseriat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
PRESSURE DROPS IN PIPING OF COMPLEX CROSS-SECTIONS [PERTE DE CHARGE DANS LES CONDUITES A SECTION COMPLEXE]
Truong Quang Minh Jan. 1970 36 p refs In FRENCH; ENGLISH summary
(CEA-BIB-173) Avail: CFSTI

Methods of predicting the pressure drops in an incompressible fluid flowing in pipes with complex cross-sections (non-circular) are

reviewed. The cross-sections considered have a square, rectangular or triangular shape, or are more complex e.g. the concentric-excentric annular space or the cross-section corresponding to the passage of a fluid in a batch of bars contained in a pressure tube. Analytical solutions are given for a small number of simple shapes for laminar flow and the numerical methods can be applied to more general cases. A number of empirical correlations are presented for turbulent flow and that of Gunn and Darling appears to be confirmed for a certain number of cross-sectional shapes. Author (ESRO)

N70-27411# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
FRICTION PRESSURE DROP MEASUREMENTS IN TURBULENT PIPE FLOW OF WATER WITH UNIFORM WALL HEAT FLUX [MESURE DU COEFFICIENT DE FROTTEMENT AVEC TRANSFERT DE CHALEUR EN CONVECTION FORCEE DANS UN CANAL CIRCULAIRE]
Jacques Lafay Feb. 1970 63 p refs In FRENCH; English summary
(CEA-R-3896) Avail: CFSTI

Measurements of the local friction pressure drop coefficient Lambda H for a forced convective turbulent flow of water, without boiling, in a uniformly heated circular tube, are reported. The effect of variable fluid properties was isolated by varying the heat flux for fixed values of the local Renolds and Prandtl numbers at 52 diameters from the beginning of the heated length; the local pressure drop was measured between two pressure taps situated on each side of this point. It was found that the evolution of the ratio Lambda H/Lambda is generally dependent upon the Reynolds numbers and the viscosity ratio mu sub p/mu sub b; no effect of the Prandtl number was detected in the studied range. The dispersion is characterized by the standard deviation value omicron such as 2 omicron = + or − 1.4% in which 98% of the experimental points were found. This correlation agrees with other measurements. Author (ESRO)

N70-27420*# Scientific Translation Service Santa Barbara, Calif.
EXPERIMENTAL STUDY OF RAREFIED GAS FLOW BETWEEN PARALLEL PLATES [EKSPERIMENTAL'NOYE ISSLEDOVANIYE TECHENIYA RAZREZHENNYKH GASOV MEZHDU PARALLEL'NYMI PLASTINKAMI]
B. T. Porodnov et al Washington NASA May 1970 11 p refs Transl. into ENGLISH from Izd. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), no. 9, 1969 p 105 111
(Contract NASw-2035)
(NASA-TT-F-12976) Avail: CFSTI CSCL 20D

The flow of inert gases, hydrogen, and deuterium in a plane-parrel slot of approximately 19 mm high formed by glass plates is studied. A minimal value of the volumetric gas flow rate is observed for Kn 1. The volumetric flow rate increases without limit for Kn > 1 in the pressure interval investigated. There is considerable difference in the experimental data for the different gases in the free molecular flow region. Anomalous behavior of neon in comparison with the other gases is noted. A comparison is made of the available theoretical results with the experimental data. Author

N70-27485# IIT Research Inst., Chicago, Ill. Dept. of Mechanical and Aerospace Engineering.
V/STOL ORIENTED AERODYNAMIC STUDIES: CALCULATION OF INCOMPRESSIBLE TURBULENT BOUNDARY LAYERS. A REVIEW OF THE AFOSR-IFP-STANFORD 1968 CONFERENCE
M. V. Morkovin and S. J. Kline (Stanford Univ.) Jul. 1969 17 p refs
(Contract F44620-69-C-0022; Proj. Themis)
(AD-702522; THEMIS-69-1; AFOSR-70-0640) Avail: CFSTI CSCL 20/4

The primary objective of the conference reviewed was calibration of the numerous procedures for analyzing turbulent boundary layers. Summaries of the state of knowledge regarding separation, the structure of turbulence, and other related physics and research needs were also undertaken. Conference preparation included selection and standardization of a set of base data for comparison with theory. Thirty-three flows were selected and 16 of these made mandatory for workers submitting prediction papers to the conference. An evaluation committee provided a rough order of merit of reliability with which various methods predict the mandatory flows, and used this information to examine the utility and promise of various physical assumptions and mathematical frameworks. Author (TAB)

N70-27528# Fraunhofer Institut, Freiburg (West Germany).
INVESTIGATIONS OF THE SIMULATION OF PLANE BLAST WAVES BY MEANS OF T-TUBE [UNTERSUCHUNGEN ZUR SIMULATION VON EBENEN BLASTWELLEN MIT DEM T-ROHR]
Gerhart Schwarzkopf 1968 110 p refs In GERMAN
(Rept-6/68) Avail: CFSTI

The analogy of the propagation of shock waves in an electromagnetic shock tube and of the propagation of a plane blast wave in a T-tube is investigated quantitatively. To this end displacement-time curves of separate shock waves were measured with a grid Schlieren method and the density variation behind the shock wave was investigated with a Mach-Zehnder interferometer. The test conditions (working gas, air, with pressures between 2 and 50 torr, shock Mach number range 1.5 less than or equal to Ms less than or equal to 4) were chosen such that the ideal gas equations, necessary for the blast wave theory, were still applicable, and to ensure that the shock fronts were clearly separated from the hot discharge plasma. The results were analyzed to see if they agreed with blast wave theory. For the application of the T-tube as a blast wave simulator, the problem of the perpendicular reflection of a plane blast wave at a rigid wall was treated for the first time. ESRO

N70-27563# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Freiburg (West Germany). Inst. fuer Angewandte Mathematik und Mechanik.
THE BREAK-UP OF A LIQUID DROPLET DUE TO AERODYNAMIC FORCES [DIE ZERSTOERUNG EINES FLUESSIGKEITSTROPFENS LAUFGRUND VON AERODYNAMISCHEN KRAEFTEN]
Wolfgang Koerner (Ph.D. Thesis—Karlsruhe Tech. Hochschule) Feb. 1970 104 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-05) Avail: CFSTI

When a low viscosity, liquid droplet is suddenly exposed to a gaseous jet with high relative velocity, it is destroyed by the shear stress and the normal stress exerted by the jet flowing past it. By use of suitable model concepts and simplifying assumptions, solutions are derived for the fluid flow in the vicinity of the symmetry axis of the droplet and in the coupled liquid and gaseous boundary layers at its front face. The deformation and mass loss of the droplet are determined from the liquid flow fields. Similar published work is reviewed. Author (ESRO)

N70-27618# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
ONE-DIMENSIONAL FLOW OF COMPRESSIBLE, BINARY GASES IN CENTRIFUGES [EINDIMENSIONALE ZENTRIFUGENSTROEMUNGEN KOMPRESSIBLER, BINAERER GASE]
Egon Krause Feb. 1970 45 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-04) Avail: CFSTI

The equations of motion and their solutions for the one-dimensional flow of a compressible, two-component gas mixture, set in motion by two co-axial, infinitely long cylinders in a centrifuge, are discussed. The region of validity of the solutions, which rest on the assumption of continuum flow, is given, and the influence of various physically possible boundary conditions on the radial profiles of the flow variables is investigated. Velocity-, temperature-, concentration-, density- and pressure distributions are presented, along with the factor of separation, and the possibility of wall cooling is discussed. Author (ESRO)

N70-27639*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

UNSTABLE BUBBLE MOTION UNDER LOW GRAVITATIONAL CONDITIONS

John B. Haggard, Jr. Washington May 1970 20 p refs
(NASA-TN-D-5809) Avail: CFSTI CSCL 20D

An experimental study was conducted to examine some fundamental aspects of the motion of single noncondensable bubbles under low gravitational conditions. An acceptable criterion was found for predicting the onset of unstable bubble motion which was consistent with published stability calculations at normal gravity. Data are also presented on the changes of frequency and amplitude of unstable (oscillatory) motion that occur in low gravity. The findings are applicable to bubbles in low-viscosity isothermal fluids at both normal and reduced gravity. Author

N70-27641*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

IMPROVED DATA AGREEMENT USING NEW EDDY VISCOSITY EQUATIONS IN A COAXIAL FREE-JET COMPUTER CODE

Henry A. Putre Washington May 1970 19 p refs
(NASA-TN-D-5835) Avail: CFSTI CSCL 20D

An existing boundary layer flow code was modified to improve the prediction of concentration and velocity profiles in two-fluid coaxially flowing free jets. Calculations were compared with air data for outer-stream to jet-stream velocity ratios of 3.4 to 39.5. These velocity ratios are expected in a coaxial flow gas core nuclear rocket engine. The inlet velocity profile strongly influenced the calculations. The best data fit was obtained with a continuous, two-region, axial formulation of eddy viscosity with no radial dependence. The evaluated coefficients were found to be independent of velocity ratio. Author

N70-27661# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ONE-DIMENSIONAL NONEQUILIBRIUM AIRFLOW

V. P. Stulov et al 1 Oct. 1969 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (USSR), no. 2, 1968 p 81–86
(AD-700346; FTD-HT-23-197-69) Avail: CFSTI CSCL 20/4

The problem of a steady, quasi-one-dimensional airflow in a current tube is solved using the inverse problem approach, taking nonequilibrium chemical and ionization reactions as well as the nonequilibrium excitation of vibrational degrees of freedom of molecular components into consideration. The application of an implicit scheme for approximating the fundamental equations made it possible to carry out computations over the whole range of nonequilibrium, i.e., from frozen to equilibrium state. Properties of nonequilibrium flow, as well as variations in temperature, vibrational energies, and concentrations of components along the current tube, are discussed. A numerical analysis of the transition to equilibrium flow past a sphere, with increasing sphere radius shows that the absence of equilibrium at a given pressure substantially affects the distribution of thermodynamic parameters and air composition, but affects the velocity to a much lesser degree. Author (TAB)

N70-27679# Boelkow G.m.b.H., Ottobrunn bei Muenchen (West Germany).

HYBRID SIMULATION OF PROPELLANT SLOSHING IN LARGE ROCKET VEHICLES [HYBRIDSIMULATION DES TREIBSTOFFSCHWAPPENS IN GROSSEN TRAEGERRAKETEN]

A. Grundmann *In* DVFLR Symp. on Hybrid Computers in Aeron. and Astronaut., Pt. 2 May 1969 p 85–99 In GERMAN (See N70-27676 13-08)
(RS-25-O) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 46,90 DM

The mathematical model of a liquid filled propellant tank, represented by a damped mechanical oscillator, is the basis of a hybrid simulation of the rocket control system. The sloshing functions, which are not directly accessible to generation in function generators, are produced in the digital portion of the hybrid computer and transmitted to the analog portion. A block diagram of the simulation arrangement is provided. ESRO

N70-27685# Fraunhofer Institut, Freiburg (West Germany).

FLOW INVESTIGATIONS WITH A LASER-INDUCED GAS DISCHARGE [STROEMUNGSUNTERSUCHUNGEN MIT HILFE DES LASERINDUZIERTEN GASDURCHBRUCHS]

G. A. Schroeder Dec. 1969 24 p refs In GERMAN
(Rept-11/69) Avail: CFSTI

For visualizing flow conditions in a gaseous flow field, gas discharges were produced in several places in the field by laser-induction. The discharge plasma and its afterglow moving in the flow were used to indicate the flow lines. As an example, the escape of powder gases from a rifle barrel after the exit of the projectile was investigated. This method was also used for investigations of very inhomogeneous and unsteady flow conditions. ESRO

N70-27686# Southampton Univ. (England). Inst. of Sound and Vibration Research.

A STUDY OF PRESSURE AND VELOCITY FLUCTUATIONS ASSOCIATED WITH JET FLOWS

J. C. Lau, H. V. Fuchs, and M. J. Fisher Feb. 1970 57 p refs
(ISAV-TR-28) Avail: CFSTI

The pressure and velocity fluctuations in the non-turbulent (core and entrainment) regions of a cold subsonic jet are studied. These regions are characterized by regular fluctuations of narrow spectral bandwidths which are in marked contrast with the kind of classifications present in the turbulent mixing region. Correlation techniques were used to determine the phase relationships between the pressure, axial and radial velocity fluctuations in each of the two regions. A major result of the study is that high correlation (coefficients as high as 0.8) exists between the pressure and velocity fluctuations. Moreover, it was found that even the fluctuations in the entrainment region were highly correlated with fluctuations in the core (coefficients of from 0.4 to 0.6 were obtained). The results were compared qualitatively with a mathematical model of convected acoustic sources. The predictions of the model were in agreement with the experimental results for each of the regions considered independently. However, they did not agree with the results obtained from correlating fluctuating quantitites on either side of the mixing region. A preliminary explanation for this is that the sources to be considered need to be of higher order form (e.g. dipoles or quadrupoles). The study gave results which provided further encouragement to the belief that static pressure fluctuations can be detected by standard microphones used in certain high mean flows provided that the turbulence level is low. Author (ESRO)

N70-27722# Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.

SCATTERING OF SURFACE WAVES BY RECTANGULAR OBSTACLES IN WATERS OF FINITE DEPTH

Chiang C. Mei and Jared L. Black 4 Mar. 1969 13 p refs Revised
(Contract Nonr-1841(59))
(AD-700897) Avail: CFSTI CSCL 20/4

The scattering of infinitesimal surface waves normally incident on a rectangular obstacle in a channel of finite depth is considered. A variational formulation is used as the basis of numerical computations. Scattering properties for bottom and surface obstacles of various proportions, including thin barriers and surface docks, are presented. Comparison with experimental and theoretical results by other investigators is also made. Author (TAB)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N70-26656 Kansas Univ., Kansas City.
PHYSICAL CONDITIONS IN THE BOW SHOCK OF THE EARTH'S MAGNETOSPHERE
Wen-Wu Shen (Ph.D. Thesis) 1969 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-21579

The interactions between the solar wind plasma and the terrestrial geomagnetic field create a sharp boundary, which is noted as the magnetosphere, to the Earth's magnetic field. Based on the hydromagnetic description of the solar wind, physical properties of the solar wind plasma and magnetic field in the bow shock, magnetosheath, and on the magnetosphere are investigated from the consideration of the magnetohydrodynamic interactions between the solar wind and the magnetosphere in the presence of an oblique interplanetary magnetic field. On the assumption of magnetohydrodynamic shock, the distribution of the pressure on the magnetosphere is obtained by integrating hydromagnetic equations from the bow shock to the magnetospheric boundary. The effect of an oblique magnetic field and the value of the adiabatic exponent in the solar wind are discussed. Dissert. Abstr.

N70-26681# Akademiya Nauk URSR, Kiev.
THE METHOD OF LABORATORY INVESTIGATION OF THE ACOUSTIC PROPERTIES OF POROUS ROCKS AT EFFECTIVE PRESSURES
T. Z. Verbitskiy and G. I. Petkevich *In its* Appl. Acoustics and Vibration Technol. 1968 p 36 43 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

The specifics of studying rocks include the fact that they are more sensitive to the effects of pressure and temperature, since their elasticity to a considerable degree depends on the properties of the liquids contained in them. Therefore, when conducting laboratory investigations it is very important to ensure the correct assignment of physical conditions, which correspond to the state of the rocks at given depths. The method of studying the elastic, and especially the absorbing, properties of rocks under these conditions are described. The selection of the design for the high pressure chamber is discussed. The described method of measurements was tested during study of the acoustical properties of a series of reservoir rocks and produced excellent results. Transl. by H.W.

N70-26682# Akademiya Nauk URSR, Kiev.
ULTRASONIC STUDIES USING MODELS OF BOREHOLE WALLS
G. I. Petkevich and B. I. Gurov *In its* Appl. Acoustics and Vibration Technol. 1968 p 44 52 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

Two-dimensional perforated models can be used for modelling certain simple problems of acoustical logging. Using the multiple profiling method permits the construction of both usual and interval hodographs and ensures sufficient precision of study. Profiling through a contact with a covering layer permits the location of its position and determination of velocity in the layers. When modeling through a sloping pocket it is possible to determine the slope of its walls and to introduce corrections for the velocities in the medium. Profiling in a three-dimensional model with a liquid covering layer permits the evaluation of the relative intensity of the waves occuring on the walls of the borehole. Transl. by H.W.

N70-26763# Rice Univ., Houston, Tex. Dept. of Space Science.
TEMPERATURE AND COMPOSITION OF THE LOWER MAGNETOSPHERE Final Report, 15 Jun. 1966 – 1 Nov. 1969
William E. Gordon 11 Dec. 1969 28 p refs Sponsored in part by ARPA
(Contract AF 49(638)-1753)
(AD-700786; AFOSR-69-3035TR) Avail: CFSTI CSCL 4/1

Observation of ionospheric temperatures and compositions are summarized and reproduced. The ionosphere from about 85-115 kilometers has been heated by radio waves and the relaxation of the medium yields collision frequencies and efficiencies. The full vector velocity of the F region has been observed for the first time and this has important impact on the understanding of the chemical and physical processes in this region. Author (TAB)

N70-26852# Kansas Univ., Lawrence. Dept. of Geography.
THE USE OF AIR PHOTOS IN A STUDY OF LANDSLIDES IN NEW GUINEA
David S. Simonett, Richard L. Schuman, and Donald L. Williams Jan. 1970 63 p refs
(Contract Nonr-583(11))
(AD-701743; TR-5) Avail: CFSTI CSCL 8/13

Techniques are described which were developed for the determination of relations between air photo and field data on landslides in New Guinea. These techniques were designed so that air photos could be used to estimate frequency of landsliding, and the ages, volumes and types of landslides as well as their contribution to denudation through time. The development, application and accuracy of the techniques is discussed. Author (TAB)

N70-26896# Alaska Univ., College. Geophysical Inst.
CHARACTERISTICS OF Pc-1 EVENTS OBSERVED AT KOTZEBUE, POINT BARROW AND COLLEGE, ALASKA
George L. Mason (Denver Univ.), Richard R. Heacock, and John O. Annexstad Nov. 1969 41 p refs Sponsored in part by NSF
(Contracts F19628-67-C-0108; F19628-68-C-0121)
(AD-701070; UAG-R-208; AFCRL-69-0423; SR-1; SR-2) Avail: CFSTI CSCL 8/14

Induction magnetometer data recorded at three Alaskan sites over several years were studied with special attention given to Pc 1-2 micropulsation events. Amplitudes and occurrences of periodically-structured Pc 1 events were found to be significantly greater at Kotzebue and College than at Barrow, the more northernly station. Amplitudes and occurrences of unstructured Pc 1-2 events tend to be greatest at Barrow. Inter-site comparisons are made for a complex, large-amplitude interval of Pc 1-2 activity which occurred on March 22-23, 1967. Comparisons of polarization sense at Barrow and College disclosed no meaningful relationship. Most structured Pc 1 events recorded at Kotzebue were also recorded at College, and vice versa, though some large-amplitude events appeared at only one site. The results of the experiment show the desirability for a still closer spacing between recording sites. Author (TAB)

N70-26900# Florida Atlantic Univ., Boca Raton. Dept. of Geography.
ELECTRONIC QUANTIFICATION AND COMPARISON OF GEOGRAPHIC PATTERNS RECORDED BY VARIOUS REMOTE SENSORS, AND AN EVALUATION OF THEIR CONTRIBUTIONS TO GEOGRAPHIC RESEARCH AND METHODOLOGY Final Report, 1 Jan. 1965-31 Jan. 1970
James P. Latham 31 Jan. 1970 15 p
(Contract Nonr-4761(00))
(AD-700947) Avail: CFSTI CSCL 8/6

The report summarizes basic research program focused upon the electronic quantification and comparison of geographic patterns recorded by various remote sensors, and evaluates their contributions to geographic research and methodology. Eight technical reports cited with abstracts cover five years of experimentation analyzing photographic, radar, and thermal IR images via means of an instrumented system using television scanning, waveform analysis, and computer processing to establish feasibility of machine categorizing of geographic patterns from integrating data in images from one or more sensors. Author (TAB)

N70-28904# Illinois State Water Survey, Urbana.
STUDY OF RAINOUT OF RADIOACTIVITY IN ILLINOIS Progress Report
Nov. 1969 49 p refs
(Contract AT(11-1)-1199)
(COO-1199-18; PR-8) Avail: CFSTI

Research during 1969 on washout and rainout of radioactive debris is summarized. On May 29, indium flares were ignited on an aircraft in the vicinity of a thunderstorm. The collection of rainout and dry fallout samples to determine the areal and temporal variability of certain trace metals was partially carried out, but due to errors the experimental results are not complete. Experiments were conducted in the laboratory to study the removal of radioactive material from the atmosphere to determine the physical processes responsible for scavenging the material both within and beneath the cloud. Bacillus subtilis spores were used in the scavenging studies in the laboratory. Results showed that particles greater than 1 micron dia were efficiently scavenged. NSA

N70-26912# Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics.
LONG-PERIOD SEISMIC METHODS FOR IDENTIFYING SMALL, UNDERGROUND NUCLEAR EXPLOSIONS Final Report
Shelton S. Alexander 31 May 1969 27 p refs
(Grant AF-AFOSR-1576-68; ARPA Order 292-68)
(AD-701750; AFOSR-70-0329TR) Avail: CFSTI CSCL 17/10

The purpose of this grant was to investigate those aspects of long-period seismic wave excitation which show promise of being diagnostic in distinguishing small explosions from earthquakes. Central to this study is the development of analysis methods to test experimentally diagnostic criteria suggested by theory and to assess the practical usefulness of these criteria. This report describes in condensed form methods for: (a) detecting and separating Love and Rayleigh waves for small events; (b) estimating spectra of weak surface wave signals; (c) combining Love and Rayleigh waves for improved surface wave magnitude estimates; (d) remotely determining crustal structure in seismic source regions; (e) determining site structure from ellipticity dispersion; (f) determining relative locations of events using P-waves and surface waves; (g) numerical computations implementing these techniques. Author (TAB)

N70-26929# Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
THE INFLUENCE OF SOLAR RADIATION REFLECTANCE ON WATER EVAPORATION
James Taylor Beard (Virginia Univ.) and David K. Hollen (Virginia Univ.) Aug. 1969 32 p refs *Its* Bull-30
(PB-188499) Avail: CFSTI CSCL 13B

The evaporation of a water reservoir may be reduced by increasing the reflectance of solar energy by the water surface. Such a change in reflectance requires surface modification such as the application of a special surface film or monolayer which has good reflecting properties. The transient energy equation was applied to an element of a water surface. Numerical methods were used to solve the equation with the aid of a digital computer. Author (USGRDR)

N70-26957# Environmental Science Services Administration, Washington, D.C. National Environmental Satellite Center.
APPLICATIONS OF ENVIRONMENTAL SATELLITE DATA TO OCEANOGRAPHY AND HYDROLOGY
E. Paul McClain Jan. 1970 16 p refs
(ESSA-NESCTM-19) Avail: CFSTI

Techniques for large-scale mapping of sea surface temperatures in clear and partly cloudy regions are being developed with the aid of high-resolution infrared data from Nimbus satellites. Digitized television pictures from the ESSA operational satellites and Applications Technology Satellites are being studied in conjunction with the relation between sunglint patterns and the ocean wave spectrum and low-level wind stress. New methods for the mapping of major snow and ice boundaries from satellite altitude have been devised and are being tested. Author

N70-26980*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
NUMERICAL CALCULATIONS OF THE STEADY-STATE, WIND-DRIVEN CURRENTS IN LAKE ERIE
Richard Gedney and Wilbert Lick (Case Western Reserve Univ.) [1969] 23 p refs Presented at 13th Conf. on Great Lakes Res., Buffalo, 31 Mar. - 3 Apr. 1970 Sponsored in part by NSF
(NASA-TM-X-52786) Avail: CFSTI CSCL 08H

A shallow lake model, which does not require the friction layers to be small by comparison with the depth of the lake, was used. In order to obtain some of the observed features of the currents, it was necessary to use a relatively small grid (3.22 kilometers). This grid was variable in size for the mesh points adjacent to the boundaries, thus permitting an accurate approximation of the boundary. The velocity as a function of depth and horizontal position is determined. Results are presented for southwesterly and northeasterly winds. In both cases, narrow bands of strong currents were found near the shore. In other areas, large subsurface gyres were evident. The calculated results compare quite well with seabed drifter measurements and other observations. Author

N70-26981*# National Aeronautics and Space Administration, Washington, D.C.
ECOLOGICAL SURVEYS FROM SPACE
1970 80 p refs
(NASA-SP-230) Avail: SOD $1.75, CFSTI CSCL 08F

The use of spacecraft for earth resources surveys is discussed for seven different disciplines, which include geography, agriculture, forestry, geology, hydrology, oceanography, and cartography. Photographs taken with different filters and types of film from the Gemini and Apollo flights illustrate the man-made changes of the earth's surface as well as natural resources. R.B.

N70-27000# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE POSSIBLITY OF MEASURING THE DIFFERENCE OF GROUP PATH DURING IONOSPHERIC SOUNDING
E. L. Afraimovich 7 Nov. 1969 7 p refs Transl. into ENGLISH from Akad. Nauk Kaz. SSR, Alma-Ata. (USSR), v. 24, no. 6, 1968 p 65-67
(AD-701029; FTD-HT-23-509-69) Avail: CFSTI CSCL 4/1

During propagation in a nonuniform magnetoactive medium (the ionosphere) a quasimonochromatic pulse lags for the group lag time. Equations are given which describe the situation. An experiment is analyzed which was performed to confirm the proposed ratio and effect of certain of the equipment parameters. Author (TAB)

N70-27058# Texas A&M Univ., College Station. Dept. of Oceanography.
A THEORY OF COASTAL UPWELLING BASED ON A TWO-LAYER OCEAN MODEL AND ITS APPLICATION TO THE EASTERN PACIFIC OCEAN
Takashi Ichiye Dec. 1969 46 p refs
(Contract Nonr-2119(04))
(AD-701333; A/M-REF-69-16T) Avail: CFSTI CSCL 8/10

Linearized equations of motion and continuity in a two-layer, beta-plane ocean for transient motion to the wind system are separated into barotropic and baroclinic modes with time scales between inertia period to about 100 days. When there is a meridional boundary, a (Kelvin) wave propagating poleward along the eastern coast is possible above the maximum frequency for the planetary (Rossby) wave in an open ocean. The amplitude of the Kelvin wave decreases exponentially from the coast. A periodic, northerly, uniform wind stress causes the upward displacement of the interface only within 100 km from the coast, the start of which has a time lag over a quarter of period after the onset of the wind. The wind system of synoptic scales excites either the planetary or the Kelvin waves of baroclinic mode according to larger or smaller time and space scales. The disturbances of the interface due to the planetary wave move westward, whereas those due to the Kelvin wave propagate poleward. Author (TAB)

N70-27063# Texas A&M Univ., College Station. Dept. of Oceanography.
EXPERIMENTS ON CIRCULATION OF THE GULF OF MEXICO AND THE CARIBBEAN SEA WITH A ROTATING TANK
Takashi Ichiye Dec. 1969 48 p refs
(Contract Nonr-2119(04))
(AD-701334; Ref-69-17-T) Avail: CFSTI CSCL 8/10

The Gulf of Mexico and the Caribbean Sea are important areas which supply positive vorticity as well as volume transport to the coastal side of the southern half of the western boundary current (Gulf Stream System) of the North Atlantic Ocean. Experiments were carried out with scale models of both basins in a circular tank of plexiglass with a diameter of 120 cm mounted on a turntable rotated at speeds between 4 and 8 r.p.m. The water movement was observed by taking time-lapse 16 mm motion pictures of dye (for deep and bottom water) and paper patches (for surface water). Author (TAB)

N70-27127*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
EARTH MODELS CONSISTENT WITH GEOPHYSICAL DATA
Frank Press [1969] 38 p refs
(Grant NGR-22-009-123)
(NASA-CR-109835) Avail: CFSTI CSCL 08K

A suite of the most recently available geophysical data are inverted by an improved Monte Carlo procedure. The data are derived from surface waves for oceanic paths, eigenvibrations of the earth, elastic wave travel time, mass and moment of inertia of the earth. A low velocity zone was required for the suboceanic mantle as was a high density lithosphere. Author

N70-27143*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
COMBINING SATELLITE ALTIMETRY AND SURFACE GRAVIMETRY IN GEODETIC DETERMINATIONS
Ronald Ging-wei Eng Young (Ph.D. Thesis) Jan. 1970 148 p refs
(Grants NGL-22-009-250; NGL-22-009-062)
(NASA-CR-86375; TE-37) Avail: CFSTI CSCL 08E

The deterministic problem is studied for combining satellite altimetry observations over ocean areas with surface gravimetry over land to determine the geoid and the gravity potential. By examining the existence and uniqueness of solutions to the equivalent mathematical problem, a mixed boundary value problem in potential theory for which a general solution method is not yet available; conditions for the validity of a Neumann series method of successive approximations are established using both analytical and numerical techniques. When altimetry data are weighted more heavily than gravimetry data, sufficient conditions are given for establishing, analytically, the validity of the method. When the altimetry and gravimetry data are weighted more evenly, a computer calculation demonstrates the validity of the method for a distribution of altimetry and gravimetry like that of the earth's ocean-land distribution. Author

N70-27174# Hawaii Inst. of Geophysics, Honolulu.
OCEAN-BOTTOM SEISMOGRAPHIC STATION (OBS) CATALOGUE OF EVENTS, 1 FEBRUARY 1967–31 JANUARY 1968
Mark E. Odegard, Normal Mark, Nelson J. Letourneau, and Tai H. Kwon 1 Sep. 1969 56 p refs
(Contract F19628-68-C-0083; ARPA Order 292)
(AD-700812; HIG-69-18; AFCRL-69-0452; DR-13; SR-1) Avail: CFSTI CSCL 17/10

The report is a catalogue of events recorded by the Columbia Ocean-Bottom Seismographic Station during the period 1 February 1967 to 31 January 1968. The text includes a description and location of the station. The list of events gives the data, time of arrival, phase identification, recording component, and, where possible, a description of the cause of the disturbance. Author (TAB)

N70-27252# Joint Publications Research Service, Washington, D.C.
BULLETIN OF OPTICAL ARTIFICIAL EARTH SATELLITE TRACKING STATIONS
11 Mar. 1970 147 p refs Transl. into ENGLISH from Byul. St. Optich. Nablyudeniya Iskusstv. Sputnikov Zemli (Moscow), no. 55, 1969 p 6 107 Presented at Seminar on Geodetic Process. of Artificial Earth Satellite Observations, Tashkent, 23-25 Nov. 1968
(JPRS-50035) Avail: CFSTI

CONTENTS:

1. ACCURACY OF RESULTS OF PHOTOGRAPHIC OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES A. M. Lozinskiy p 6 9 refs (See N70-27253 13-14)

2. REQUIREMENTS ON ACCURACY OF OPTICAL OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES FOR GEODETIC PURPOSES Yu. V. Batrakov p 10 21 refs (See N70-27254 13-30)

3. GENERAL REMARKS REGARDING POSSIBILITIES OF USING ARTIFICIAL EARTH SATELLITE OBSERVATIONS WHEN DEVELOPING GROUND GEODETIC NETWORKS V. Dobachevska p 22 28 refs (See N70-27255 13-13)

4. EXPEDIENT MEANS OF JOINT PROCESSING OF GROUND AND COSMIC TRIANGULATION L. P. Pellinen p 27 37 refs (See N70-27256 13-13)

5. PROBLEMS OF CONSTRUCTING A COORDINATE SYSTEM REFERENCED TO THE CENTER OF MASS AND AXIS OF ROTATION OF THE EARTH A. A. Izotov p 38 49 refs (See N70-27257 13-13)

6. MOTION OF THE POLES OF THE EARTH AND ASTRONOMICAL GEODETIC WORK I. D. Zhongolovich p 50 56 refs (See N70-27258 13-13)

7. DETERMINATION OF THE SHAPE AND GRAVITATIONAL FIELD OF THE EARTH FROM OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES K. Arnold p 57 77 (See N70-27259 13-13)

8. JOINT CORRECTION OF GRAVIMETRIC AND SATELLITE DATA WHEN DETERMINING THE EARTH'S GRAVITATIONAL FIELD L. P. Pellinen p 78 90 refs (See N70-27260 13-13)

9. ERRORS IN DETERMINING THE EARTH'S POTENTIAL BY MEASUREMENTS OF GRAVITATIONAL FORCES ON A KNOWN SURFACE V. G. Shkodrov p 91 97 refs (See N70-27261 13-13)

10. ROLE OF SATELLITE GEODESY IN FURTHER DEVELOPMENT OF CONTINENTAL ASTRONOMICAL-GEODETIC NETWORKS M. Shedlikh p 98 108 (See N70-27262 13-13)

11. VARIATE APPLICATION OF MULTIPLE FIXES IN ELEMENTARY COSMIC TRIANGULATION B. A. Firago p 109 115 refs (See N70-27263 13-30)

12. APPLICATION OF THE VECTOR FORMULA OF A GREAT CIRCLE IN COSMIC TRIANGULATION A. A. Kiselev p 116 124 refs (See N70-27264 13-30)

13. CONSTRUCTION OF COSMIC TRIANGULATION BY CHORD DIRECTIONS AND LENGTHS B. M. Klenitskiy p 125 135 refs (See N70-27265 13-30)

14. UTILIZATION OF OPTICAL OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES WITH TIME ERRORS IN COSMIC GEODESY Yu. V. Batrakov p 136 145 refs (See N70-27266 13-30)

N70-27255# Joint Publications Research Service, Washington, D.C.

GENERAL REMARKS REGARDING POSSIBILITIES OF USING ARTIFICIAL EARTH SATELLITE OBSERVATIONS WHEN DEVELOPING GROUND GEODETIC NETWORKS

V. Dobachevska *In its* Bull. of Opt. Artificial Earth Satellite Tracking Sta. Mar. 1970 p 22 26 refs (See N70-27252 13-13)

Avail: CFSTI

A network of points is obtained which represents satellite triangulation with lengths of sides from 1,000 to 4,000 km. The point coordinates of this network are determined in the spatial coordinate system connected with the Earth. The directions are determined of the chords joining the satellite stations, and, in particular, the azimuths of these chords, used when developing ground networks. Author

N70-27256# Joint Publications Research Service, Washington, D.C.

EXPEDIENT MEANS OF JOINT PROCESSING OF GROUND AND COSMIC TRIANGULATION

L. P. Pellinen *In its* Bull. of Opt. Artificial Earth Satellite Tracking Sta. 11 Mar. 1970 p 27 37 refs (See N70-27252 13-13)

Avail: CFSTI

Formulas are presented for accuracy estimation of the chord connecting remote points of the earth's surface by measurement data in the astronomical-geodetic network. When using corrected polygonal constructions the errors are decreased by 25-40 percent. It is recommended that photographic observations of the satellites be used to decrease geodetic construction errors, taking the vertical coordinates obtained from the ground measurements. The problem is solved for decreasing the distances between the observation stations and the flight altitude of the artificial Earth satellite. Author

N70-27257# Joint Publications Research Service, Washington, D.C.

PROBLEMS OF CONSTRUCTING A COORDINATE SYSTEM REFERENCED TO THE CENTER OF MASS AND AXIS OF ROTATION OF THE EARTH

A. A. Izotov *In its* Bull. of Opt. Artificial Earth Satellite Tracking Sta. 11 Mar. 1970 p 38 49 refs (See N70-27252 13-13)

Avail: CFSTI

The possibilities of constructing a geodetic coordinate system referenced to the center of mass and axis of rotation of the Earth and also problems of selecting the mean initial meridian and the mean pole of the Earth are investigated. It is demonstrated that the center position of the reference ellipsoid and the direction of its small axis can be determined only by observing artificial Earth satellites. Author

N70-27258# Joint Publications Research Service, Washington, D.C.

MOTION OF THE POLES OF THE EARTH AND ASTRONOMICAL-GEODETIC WORK

I. D. Zhongolovich *In its* Bull. of Opt. Artificial Earth Satellite Tracking Sta. 11 Mar. 1970 p 50 56 ref (See N70-27252 13-13)

Avail: CFSTI

The detailed derivation of the formulas for the pole displacement effect on lattitudes, longitudes, and azimuths is studied, as well as geocentric rectangular coordinates of the earth's surface. Author

N70-27259# Joint Publications Research Service, Washington, D.C.

DETERMINATION OF THE SHAPE AND GRAVITATIONAL FIELD OF THE EARTH FROM OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES

K. Arnold *In its* Bull. of Opt. Artificial Earth Satellite Tracking Sta. 11 Mar. 1970 p 57 77 (See N70-27252 13-13)

Avail: CFSTI

Geometric satellite geodesy determined the positions of the satellite observation stations; the coordinates are considered as relative variables based on the null point. Dynamic satellite geodesy permits determination of the observation station coordinates with respect to the center of gravity of the earth and establishment of the dimensions of the earth's gravitational field. The observation station coordinates, orbital elements, and parameters of the earth's gravitational field can be obtained only jointly. Selected special partial problems are investigated since the effect of perturbations can be neglected. Author

N70-27260# Joint Publications Research Service, Washington, D.C.

JOINT CORRECTION OF GRAVIMETRIC AND SATELLITE DATA WHEN DETERMINING THE EARTH'S GRAVITATIONAL FIELD

L. P. Pellinen *In its* Bull. of Opt. Artificial Earth Satellite Tracking Sta. 11 Mar. 1970 p 78 90 refs (See N70-27252 13-13)

Avail: CFSTI

A procedure is proposed for joint processing of gravimetric and satellite data to determine the coefficients in the gravitational potential expansion of the earth. The expansion coefficients determined from the satellite observations and anomalies of the Faye gravitational force averaged on a constant radius are taken as the measured variables. In excluding the effect of the high-order harmonics, it is recommended that strongly smoothed anomalies be used and that when compiling the error equations, the differencies of the anomalies are calculated. Proposals are made regarding weight determination of the gravitational anomalies and the harmonic coefficients obtained from satellite observations. Author

N70-27261# Joint Publications Research Service, Washington, D.C.

ERRORS IN DETERMINING THE EARTH'S POTENTIAL BY MEASUREMENTS OF GRAVITATIONAL FORCE ON A KNOWN SURFACE

V. G. Shkodrov *In its* Bull. of Opt. Artificial Earth Satellite Tracking

Sta. 11 Mar. 1970 p 91-97 refs (See N70-27252 13-13)
Avail: CFSTI

Expressions are obtained for the coefficients of the gravitational potential expansion in terms of the known characteristics of a physical surface and the gravitational distribution on it. The values are calculated for the model with two attracting points. With respect to gravimetric measurements, it is expedient to determine sectorial harmonics and the harmonics with large second indexes. The zonal harmonics and harmonics with small second indexes are determined by he movement of satellites. Author

N70-27262# Joint Publications Research Service, Washington, D.C.
ROLE OF SATELLITE GEODESY IN FURTHER DEVELOPMENT OF CONTINENTAL ASTRONOMICAL-GEODETIC NETWORKS
M. Shedlikh *In its* Bull. of Opt. Artificial Earth Satellite Tracking Sta. 11 Mar. 1970 p 98-108 (See N70-27252 13-13)
Avail: CFSTI

Euclidean or spherical-ellipsoidal measurements of dynamic and geometric geodesy are assessed. The priority of mapping clarity is also emphasized. Author

N70-27270# Woods Hole Oceanographic Institution, Mass.
REFERENCE NO. 69-90. BIBLIOGRAPHY Technical Reports, 1969
Cecelia B. Fuglister, comp. Apr. 1970 19 p refs
Avail: CFSTI

Technical reports, containing oceanographic data, are listed chronologically and by author and contract indexes. Author

N70-27290*# Radiometric Technology, Inc., Cambridge, Mass.
DEGRADATION BY THE ATMOSPHERE OF MICROWAVE RADIOMETRIC OBSERVATIONS FROM SPACE - 0.5 TO 20 GHz, VOLUME 1 Final Report
Ronald A. Porter, Norman E. Gaut (Environ. Res. and Technol., Inc.), and Edward C. Reifenstein, III (Environ. Res. and Technol., Inc.) 30 Apr. 1970 205 p refs
(Contract NAS12-2120)
(NASA-CR-86384) Avail: NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Md. 20740 CSCL 04A

The atmospheric conditions over La Jolla, California are simulated each day for one year. Using the simulated atmospheres, certain microwave properties are computed for each day. From the computations, statistics are assembled which provide for an estimation of the effect of the atmosphere on microwave brightness temperatures measured from space over four seasons and over the year. It is determined that to reduce the effects of the atmosphere to below 1 K rms in the region near La Jolla, frequencies below approximately 9 GHz must be used. In addition, the microwave properties of clouds are explored for the restrictions which apply to the application of the simple Rayleigh theory to computations of absorption and emission. It is found that for frequencies below 20 GHz and for clouds which have droplets no larger than 100 microns the Rayleigh approximation to the absorption coefficient is satisfactory. Data is presented showing the atmospheric contribution to microwave radiometric observations from space, over ocean surfaces, for various viewing angles and four weather models: clear, moderate cloud, light rain, and heavy rain. Finally, several ocean surface temperature sensing techniques are established and evaluated, utilizing the above atmospheric data. Tests are performed on selected techniques with the aid of experimental radiometric information. See also N70-27291. Author

N70-27291*# Radiometric Technology, Inc., Cambridge, Mass.
DEGRADATION BY THE ATMOSPHERE OF MICROWAVE RADIOMETRIC OBSERVATIONS FROM SPACE - 0.5 TO 20 GHz, VOLUME 2 Final Report
Ronald A. Porter, Norman E. Gaut, and Edward C. Reifenstein, III 30 Apr. 1970 283 p
(Contract NAS12-2120)
(NASA-CR-86385) Avail: CFSTI CSCL 04A

Plots and printouts are given for brightness temperatures and emissivities of sea water and for the temperature dependence of sea water brightness temperatures. See also N70-27290. R.B.

N70-27312*# Michigan Univ., Ann Arbor. High Altitude Engineering Lab.
HIGH ALTITUDE RADIATION MEASUREMENTS Quarterly Report, 1 Oct. - 31 Dec. 1969
Fred L. Bartman Feb. 1970 22 p refs
(Contract NASr-54(03); ORA Proj. 05863)
(NASA-CR-109774) Avail: CFSTI CSCL 04A

Project activity during the period 1 October 1969 to 31 December 1969 are summarized. Adjustments, tests and modifications of the Jarrell Ash 1.8 meter spectrometer, which are being made prior to measurements of the 15 m band of CO2, are reported and plans for systematic analysis of the data are described. The considerations leading up to the construction of a simplified ozone generating, handling and measuring system are discussed. Results of the survey of the literature on the distribution of CO2 in the earth's atmosphere are indicated. Author

N70-27325*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE GEOLE PROJECT [LE PROJET GEOLE]
J. C. Husson Washington NASA Dec. 1969 34 p Transl. into ENGLISH from CNES Report (French), 5 Jun. 1969 31 p
(Contract NASw-1692)
(NASA-TT-F-12645) Avail: CFSTI CSCL 08E

The GEOLE project is centered on geodesy by satellite based on a world-wide polyhedron of radar beacons. Thus GEOLE will provide a means to separate the dynamic geodetic problem from the geometric one. The various functions and missions of the satellite are described briefly, and the methods to be used to fulfill these objectives are discussed. Author

N70-27356*# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
THE MAGNETOSPHERIC PLASMAPAUSE AND THE ELECTRON DENSITY TROUGH AT THE ALOUETTE 1 ORBIT
M. J. Rycroft and J. O. Thomas Apr. 1968 43 p refs Sponsored in part by NASA, NAS-NRC and Sci. Res. Council
(NASA-CR-109765) Avail: CFSTI

The location of the magnetospheric plasmapause or 'knee' and the position of the electron density minimum or 'trough' at the orbit of the Alouette 1 satellite near 1000 km have been derived from whistler data and from topside ionograms respectively. A statistical study of the dependence of both knee and trough positions on the degree of magnetic disturbance and on local time during the summer of 1963 reveals that, in general, within the statistical scatter, the geomagnetic field lines on which each occur are the same. It is inferred that the plasmapause in the magnetosphere and the trough near the exospheric base are related phenomena, and that a sharp decrease of plasma density occurs beyond a particular field line, the position of which depends on local time and on the degree of geomagnetic activity. For magnetically quiet conditions (kp = 0), this line of force corresponds to L approximately 5.6 near midnight, whereas for moderate magnetic activity (kp = 3) its L value is approximately 4. The radial distance at which this field line crosses the equatorial plane decreases at a rate of approximately 0.1 earth radii/hour throughout the local night. The geomagnetic latitude at which the field line concerned reaches an altitude of 1000 km is approximately 57 deg at 02.00 LT for Kp approximately 3, and decreases at a rate of 1.8 deg + or - 0.4 deg per unit increase of Kp. Author (ESRO)

N70-27391# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
THE TRANS-POLAR EXOSPHERIC PLASMA. PART 1: THE PLASMASPHERE TERMINATION
J. O. Thomas and M. K. Andrews May 1968 40 p refs
Avail: CFSTI

From an examination of many trans-polar exospheric electron density distributions along tracks of the Alouette 1 satellite at a fixed direction to the Earth-Sun line, it is found that there is an approximately characteristic profile for a given direction. It is suggested that this implies a fixed density distribution over the polar regions. If it is assumed that the ionospheric trough at high latitudes is a demarcation between solar-produced ionization laying inside the plasmasphere and aurorally-associated ionization at high latitudes, the mid-latitude termination is the low latitude wall of the trough. From a study of many topside sounder records obtained during the polar winter, the position of this termination is located at the F peak at all local times and its motions investigated. Its position is found to be most clearly defined and correlated with Kp in the 1800 LT region, when the plasmapause is most unstable. However, when the trough is compared with the position of the plasmapause projected back along field lines, systematic differences in position are apparent which may be related to field line distortions in the magnetosphere. Author (ESRO)

N70-27428*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC FIELD AND ELECTRON OBSERVATIONS NEAR THE MAGNETOPAUSE
K. W. Ogilvie, J. D. Scudder, and M. Sugiura Apr. 1970 28 p refs Presented at the Intern. STP Symp., Leningrad, 11-19 May 1970
(NASA-TM-X-63900; X-692-70-159) Avail: CFSTI CSCL 08N

Observations of electron fluxes at energies between 25 ev and 130 ev by the triaxial electron spectrometer on OGO-E, and of the magnetic field by the magnetometer on the same satellite, are used to study the magnetopause at quiet and at fairly disturbed times. They indicate that the boundary, whose thickness of order 100 km is sometimes resolved, is either at rest or moving with a speed of order several km/sec with an amplitude of 1-2 R sub E. Pressure balance indicates that beta in the magnetosphere close to the boundary is frequently of order unity. This in turn indicates the presence of plasma adjacent to the magnetopause on the dawn side, in agreement with other observers. Author

N70-27432*# National Aeronautics and Space Administration, Washington, D.C.
ORGANIZATION OF PROJECT EOLE [ORGANISATION DU PROJET EOLE]
R. Aubiniere May 1970 23 p ref Transl. into English from CNES, Decision no. 28 (Paris), 3 Apr. 1970 21 p
(NASA-TT-F-13091) Avail: CFSTI CSCL 04A

A description of the EOLE project is given along with its organization into subprojects. The responsibilities of individual divisions and management personnal, and its relations with NASA are given. Author

N70-27443# Army Corps of Engineers, Washington, D.C. Beach Erosion Board.
AN EXPERIMENTAL STUDY OF SUBMARINE SAND BARS
1970 47 p refs
(AD-701197; TR-3) Avail: CFSTI CSCL 8/3

The paper reports the results of experiments made to determine the existence of basic relationships governing sand bar phenomena. Observations were made of the form, dimensions, and number of bars; wave characteristics; ripple formation; and nature and volume of sand movement involved in bar phenomena. TAB

N70-27488# Royal Aircraft Establishment, Farnborough (England).
THE SHAPE OF THE EARTH
D. G. King-Hele Sep. 1969 16 p refs Presented at the Brit. Assoc. Meeting, Exeter, Engl., Sep. 1969
(RAE-TM-SPACE-130) Avail: CFSTI

This report gives a brief description of classical geodetic methods and reviews the progress made since the launching of the first artificial satellite. The effects of the Earth's flattening on a satellite orbit and the latest values of the even and odd zonal harmonics are discussed. Author (ESRO)

N70-27501# Army Tropic Test Center, Fort Clayton (Canal Zone).
ENVIRONMENTAL DATA BASE FOR REGIONAL STUDIES IN THE HUMID TROPICS Semiannual Report, 1 Mar. 1968 – 28 Feb. 1969
Edward E. Garrett, ed. Oct. 1969 91 p refs
(ARPA Order 740)
(AD-701109; USATTC-6909003; SA-6; SA-7) Avail: CFSTI CSCL 4/2

The report, summarizes the activities of the Environmental Data Base Project for the period March 1968 through 1969 and contains a brief statement on project background, scope, and observation sites, together with some analyses of the collected data. The Climate Section contains an operational description of the automatic data and recording system, a detailed analysis of the climatological and measurement aspects of evaporation. The Soils and Hydrology Section presents the profile descriptions of the soils at the Fort Kobbe Satellite Sites. The Vegetation Section contains an analysis of litter fall at the Albrook Forest Site. The section of Atmospheric Chemistry consists of a brief summarization of activities in this field for the reporting period. The section on Macrofauna contains a tabulated listing of insects secured under the black-light sampling program. Author (TAB)

N70-27518# Nevada Univ., Reno. Mackay School of Mines.
A SELECTED EVENTS RECORDER FOR SEISMIC APPLICATIONS
Dan P. Hunt Nov. 1969 151 p refs
(Grants AF-AFOSR-68-1564; AF-AFOSR-66-646)
(AD-701761; AFOSR-70-0330TR) Avail: CFSTI CSCL 8/11

The document describes a developmental, suitcase-size portable seismic recording station specifically tailored to micro-earthquake investigation. The total instrument package, including recorder, 24-hour battery pack, radio antenna, seismometer, and field wire weighs less than 100 pounds and can be hand-carried by two people into remote areas not accessible by other means. The recorder portion of the station is a two-channel, low speed, instrumentation-type magnetic tape recorder which was developed for this particular application. This recorder has the unique capability to edit incoming data and record only those signals that exceed a preset amplitude threshold while retaining the low-level preamble to the recorded event. A time signal derived from a National Bureau of Standards (WWVB) broadcast is recorded with the data to provide accurate event-time correlation. Author (TAB)

N70-27560# Army Corps of Engineers, Washington, D.C. Beach Erosion Board.
A SUMMARY OF THE THEORY OF OSCILLATORY WAVES
1970 52 p
(AD-701196; TR-2) Avail: CFSTI CSCL 8/3

Quantitative predictions of the effect of wave action in shore-line processes requires, first, statistical information on the wave height, length, period, and direction, and water depth, at each locality for each season; and second, a precise knowledge of the behavior of waves approaching a shore line through deep water, into and through shoaling water. This paper deals with the second phase only, presenting a summary of the theoretical treatments of oscillatory wave motion on a free water surface. It is limited to

the type of wave encountered in shore protection problems. Much of the theory requires experimental verification, and mention will be made of the extent to which confirmation has been obtained, without, however, quoting experimental results. TAB

N70-27594# Royal Aircraft Establishment, Farnborough (England).
REVISED PROFILES OF AIR DENSITY AT HEIGHTS OF 130 TO 180 KM, FROM THE ORBITS OF 1968-59A AND B
D. G. King-Hele and Doreen M. C. Walker Jun. 1969 9 p
(RAE-TM-SPACE-127) Avail: CFSTI

The values of air density obtained by analyzing the orbits of the satellites 1968-59A and B (OV1 15, OV1 16) have been revised with the aid of new information. The new profiles of density versus height give values of density between 3% and 9% greater than before: this increase is just significant, since the estimated standard deviation is 8%. Author (ESRO)

N70-27599# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
ULTRA LOW FREQUENCY WAVES IN THE MAGNETOSPHERE
J. W. Dungey and D. J. Southwood Aug. 1969 38 p refs
Avail: CFSTI

A brief summary is first given of the more important properties (latitude, dependence, diurnal variation, polarization) of continuous pulsations (pc 2-5) observed on the ground. The remainder of the paper is devoted to recent developments in the theory of resonant modes of magnetospheric models, magnetospheric instability and low frequency waves in the magnetosphere. The theoretical results are in good agreement with observations from Explorer 33 and ATS 1. Author (ESRO)

N70-27671# California Inst. of Tech., Pasadena. Div. of Geological Sciences.
RESEARCH IN GEOCHEMISTRY Progress Report
Samuel Epstein 1 Oct. 1969 21 p refs
(Contract AT(04-3)-767)
(CALT-767-P-7-45) Avail: CFSTI

Studies in geochemistry showed that industrial lead is being washed into the shallow layers of the oceans and into the surface ocean waters at a rapid rate. The usefulness of lead geochronology depends on understanding the geochemistry of the U Th Pb system in Earth. Feldspars from Canada and Wyoming were investigated and showed different lead deposition rates. The geochemical stability of U Th Pb in zircon was found to be dependent upon the history of the zircon in the rocks. Efforts to understand the D/H ratio distribution in earth materials progressed in the realm of the biological materials from both ancient and recent times. A mass spectrometer was constructed for the determination of the 30Si/28Si isotope variations in natural materials. Author (NSA)

N70-27698 National Lending Library for Science and Technology, Boston Spa (England).
SOME BASIC PROBLEMS OF MODERN OCEANOGRAPHY
I. V. Maksimov et al 28 Nov. 1969 31 p refs Transl. into ENGLISH from Tr. Arkt. Antarkt. Nauchn.-Issled. Inst. (Leningrad), no. 32, 1969 p 5-18 In ENGLISH and RUSSIAN
(NLL-M-9409-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The main global problems associated with study of the ocean are discussed. Long-period tides in the ocean and the problem of their effect on heat transfer by ocean surface and on the climate of the earth are considered. Long-term observations of fluctuations in the mean level in different regions of the ocean show significant secular and 11-year variations related to solar activity variations. The same phenomena are observed in variations of the ice cover in the Arctic Basin, also due to solar activity variations. R.B.

N70-27744 National Lending Library for Science and Technology, Boston Spa (England).
TEMPERATURE AND SALINITY CHARACTERISTICS OF SURFACE WATER IN POLYNYAS IN THE ARCTIC BASIN
A. O. Spajher et al 28 Nov. 1969 11 p refs Transl. into ENGLISH from Russian report
(NLL-M-7960-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

Summer temperature and salinity measurements in a polynya and under ice cover are presented. Seasonal changes in the water under ice are found to be insignificant due to the high albedo of the ice cover. Melt water seeping under the ice refreezes on contact with the cold water. Changes in surface temperature and salinity in the polynya are most intense in the first half of July in a 100 cm layer, and changes extend to 150 cm in the last half of July. Rapid cooling and increased salinity occur in August. Melt water flowing into the polynya differs in density and does not mix with the Arctic waters. It is concluded that summer heating affects only a comparatively thin layer of relatively fresh water. N.E.N.

N70-27752# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
KLEINHEUBACHER REPORTS, VOLUME 13 [KLEINHEUBACHER BERICHTE, BAND NR. 13]
1969 256 p refs In GERMAN; ENGLISH summaries Proc. of the Joint Meeting of the Ionospheric Working Group of the Ger. Natl. URSI Comm. and the Comm. for Wave Propagation of the NTG, Kleinheubach, West. Ger., 1968
Avail: CFSTI

Symposium papers on geophysical research, ionospheric observation of solar activity, radio bursts and VLF propagation through the ionosphere are presented. For individual titles, see N70-27752 through N70-27789.

N70-27754# Tubingen Univ. (West Germany).
OPTICAL SCATTERING COEFFICIENT AND AEROSOL CONCENTRATION IN THE TROPOSPHERE AND STRATOSPHERE FROM RADIOSONDE MEASUREMENTS OF THE POLARIZATION OF SCATTERED SOLAR RADIATION AT THE ZENITH [OPTISCHER STREUKOEFFIZIENT UND AEROSOLKONZENTRATION IN TROPOSPHAERE UND STRATOSPHAERE AUS MESSUNGEN DER POLARISATION DER SONNENSTREUSTRAHLUNG IN ZENIT MITTELS RADIOSONDEN]
F. Unz *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 7-15 refs In GERMAN; ENGLISH summary (See N70-27752 13-13)
Avail: CFSTI

Assuming a power law size distribution of aerosols a method was developed which allows one to determine the exponent of the law and the turbidity in the troposphere and stratosphere, as a result of measuring the degree of polarization on two wavelengths. The scattering coefficients and absolute concentrations of the particles can be derived as functions of height from the values of turbidity. Measurements between October 1965 and June 1966 showed great fluctuations in the value and weight of the maximum stratospheric turbidity. Extremely high turbidity values occurred in fall 1965 and summer 1966 between 22 and 26 km. The highest concentration of aerosol particles with a radius greater than 0.08 micron at this height was nearly 50 particles/cu cm. In spring 1966 the stratospheric turbidity was much lower, the maximum being between 12 and 16 km. A turbidity minimum is always present in troposphere. Similar results were obtained in September 1968. Author (ESRO)

N70-27767# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Abteilung Weltraumphysik.
COOPERATIVE EVALUATION OF SATELLITE SIGNALS

FOR THE DETERMINATION OF IONOSPHERIC ELECTRON CONTENT BY TWO OBSERVATION STATIONS [GEMEINSAME AUSWERTUNG VON SATELLITENSIGNALEN ZUR ERMITTLUNG DES ELEKTRONENINHALTS DER IONOSPHAERE FUER ZWEI BEOBACHTUNGSSTATIONEN]

A. Ebel, G. Hartmann, R. Leitinger, G. Schmidt and J. P. Schoedel *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 29 36 refs In GERMAN Prepared jointly with Koeln Univ. and Graz Univ. (See N70-27752 13-13)

Avail: CFSTI

Observations of the Faraday effect at Graz and Lindau during 5 passes of Explorer 22 were evaluated by 3 different methods. Comparisons of values obtained for the ionospheric electron content showed, among other things, that the Faraday difference method can be used for southerly satellite positions and for great zenith distances, but it cannot be used for northerly positions. The differences in the results obtained with the three methods (two programmed, one manual) mainly stem from the different treatments by equalization. Author (ESRO)

N70-27758# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Ionosphaerenphysik.

DETERMINATION OF THE FINE STRUCTURE OF THE IONOSPHERE WITH IONOGRAMS [DIE BESTIMMUNG DER FEINSTRUKTUR DER IONOSPHAERE AUS IONOGRAMMEN]

W. Becker *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 37 44 refs In GERMAN (See N70-27752 13-13)

Avail: CFSTI

A description is given of a closed unit for determining the fine structure of the ionosphere. It consists of a high power ionosonde, a semiautomatic digital data processing device, and a very general program for calculating the electron density/height profiles from ionograms of ground or satellite stations. A few examples are discussed. Author (ESRO)

N70-27763# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Ionosphaerenphysik.

RESULTS OF AURORAL OBSERVATIONS IN THE IGY AND IQSY WITH SPECIAL CONSIDERATION OF THE GERMAN CONTRIBUTIONS [ERGEBNISSE DER POLARLICHTBEOBACHTUNGEN IM IG AND IQSY UNTER BESONDERER BERVECKSICHTIGUNG DER DEUTSCHEN BEITRAEGE]

Guenther Lange-Hesse *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 81 92 refs In GERMAN (See N70-27752 13-13)

Avail: CFSTI

A description is given of the geographical spread of auroral light (the auroral light oval), the diurnal variations of the light abundancy which is dependent on geomagnetic latitude and the influence of geomagnetic and solar activity. An observation network using all sky cameras is also described. ESRO

N70-27764# Oulu Univ. (Finland). Abteilung fuer Elektrotechnik.

MOVEMENTS OF SCINTILLATION BOUNDARY IN THE POLAR IONOSPHERE [BEWEGUNGEN DER SZINTILLATIONSGRENZE IN DER POLAREN IONOSPHAERE]

A. Tauriainen *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 93 96 refs In GERMAN; ENGLISH summary (See N70-27752 13-13)

Avail: CFSTI

The occurrence of scintillations in the Faraday rotation observed at Sodankyla and Oulu were studied. Special attention was paid to the sudden beginning of a scintillation. The observations show that the scintillation frontier in the polar ionosphere moves to the south before midnight and back to the north some hours later. This movement seems to have a connection with similar movements of the trough in the electron content observed during the night in the auroral zone. Author (ESRO)

N70-27766# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Ionosphaerenphysik.

CONSIDERATION OF OHMIC LOSSES IN THE INTERPRETATION OF OBSERVED GRAVITY WAVES IN THE F-REGION [BERUECKSICHTIGUNG OHMSCHER VERLUSTE BEI DER INTERPRETATION VON BEOBACHTETEN SCHWEREWELLEN IN DER F-REGION]

J. Klostermeyer *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 105 108 refs In GERMAN; ENGLISH summary (See N70-27752 13-13)

Avail: CFSTI

This investigation deals with the contribution of ohmic losses to the attenuation of observed gravity waves in the F region. For this purpose the ohmic losses are derived from the equation of energy conservation. It is shown that they represent the main part of the total energy loss in the F layer maximum. Author (ESRO)

N70-27767# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Ionosphaerenphysik.

AN EXPERIMENTAL INVESTIGATION OF THE DEPENDENCE ON SOLAR ACTIVITY OF THE ELECTRON DENSITY DISTRIBUTION IN THE NIGHT F-LAYER [EINE EXPERIMENTELLE UNTERSUCHUNG ZUER ABHAENGIGKEIT DER ELEKTRONENDICHTE-VERTEILUNG IN DER NAECHTLICHEN F-SCHICHT VON DER SONNENAKTIVITAET]

W. Becker *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 109–113 refs In GERMAN (See N70-27752 13-13)

Avail: CFSTI

This report concerns the dependence on solar activity and the limiting frequency of the F-layer, the electron content of a vertical column of 1 sq cm cross section up to the maximum of that layer, the F-layer height and, the curvature parameter in the F-maximum of the electron density/height profile of the midnight ionosphere. The investigations are mainly based on ionospheric work at Lindau. For comparison some results for Mysore (India), Tsumeb (South-West Africa), and the geographic South Pole are also presented. Author (ESRO)

N70-27769# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Ionosphaerenphysik.

A THEORETICAL INVESTIGATION OF THE DEPENDENCE ON SOLAR ACTIVITY OF THE ELECTRON DENSITY DISTRIBUTION NEAR THE MAXIMUM OF THE NIGHT F-LAYER [EINE THEORETISCHE UNTERSUCHUNG DER ABHAENGIGKEIT DER ELEKTRONENDICHTEVERTEILUNG IN DER NAEHE DES MAXIMUMS DER NAECHTLICHEN F-SCHICHT VON DER SONNENAKTIVITAE]

R. Ruester *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 115–119 refs In GERMAN; ENGLISH summary (See N70-27752 13-13)

Avail: CFSTI

The system of partial differential equations describing the behaviour of the night-time F-layer under the influence of gravity, diffusion, viscosity, external mechanical, and electromagnetic forces, is solved numerically under additional conditions. Among other things the results allow one to derive a numerical relation between the curvature of the F2-layer maximum and the temperature there, which depends on the solar activity. This relation is in good agreement with the observed results. Author (ESRO)

N70-27770# Tubingen Univ. (West Germany). Astronomisches Inst.

RELATION BETWEEN THE ELECTRICAL PARAMETERS OF AIR AND SOLAR AND AURORAL ACTIVITY [ZUSAMMENHANG ZWISCHEN LUFTELEKTRISCHEN PARAMETERN UND SONNENAKTIVITAET BZW. NORDLICHTERN]

R. Muehleisen *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 129 133 refs In GERMAN (See N70-27752 13-13)

Avail: CFSTI

The results of many reports on the relations between the electrical parameters of air and solar activity are combined. A certain parallel between the phenomena seems to exist, which might be explained by an increase of the ionizing radiation during solar events, especially in the higher atmospheric layers. Other hypotheses, such as that of direct solar influence on thunderstorm activity, or that of the formation of field-changing space charges by injections of charged particles, are controversial. Author (ESRO)

N70-27781# Air Force Cambridge Research Labs., Bedford, Mass.

MAGNETOSPHERIC MOTION CONSIDERING THE INCLINED EARTH'S MAGNETIC AXIS [BEWEGUNG IN DER MAGNETOSPHAERE MIT BERUECKSICHTIGUNG DER GENEIGTEN MAGNETACHSE]

H. Poeverlein *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 199–201 refs In GERMAN; ENGLISH summary (See N70-27752 13-13)

Avail: CFSTI

Large-scale motions in the magnetosphere are affected by the inclination of the geomagnetic axis to the rotational axis. Co-rotation of magnetospheric plasma with the earth requires a motion component of the plasma along the magnetic force lines. Slippage in this motion due to insufficient viscous forces causes a density build-up in some areas and motions that are part of a circulatory system are displaced to an earlier or later time, depending on the magnetic declination. Motions in the vertex of force line tubes are controlled by the position of the vertex with respect to the ecliptic plane, thus depending on season and position of the magnetic axis. Author (ESRO)

N70-27782# Gottingen Univ. (West Germany).

OBSERVATIONS OF THE BEHAVIOR OF PULSATIONS OF THE TYPE pi2 [BEOBACHTUNGSERGEBNISSE UEBER DAS VERHALTEN VON PULSATIONEN DES TYPS PI2]

H. Voelker *In* Fernmeldetech. Zentralmt Kleinheubacher Rept., Vol. 13 1969 p 203–211 refs In GERMAN; ENGLISH summary (See N70-27752 13-13)

Avail: CFSTI

The results of a direct comparison as well as a statistical investigation of pi2-type pulsations recorded with standardized equipment at observatories in an near the auroral zone and at middle geomagnetic latitudes are given. It is shown that for low geomagnetic activity the pi2 occurring in the afternoon are in phase for the observatories from Wingst up to Tromso near the auroral zone. At a later time the H-components of the pi2 observed at Tromso, Kiruna, and Sodankyla are antiparallel to those at lower latitudes. The variation of the pi2 amplitudes with geomagnetic latitude as a function of local time is discussed. Author (ESRO)

N70-27785# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Stratosphaerenphysik.

X-RAY RADIATION IN THE AURORAL ZONE: MOTION OF AREA OF INCIDENCE [ROENTGENSTRAHLUNG IN DER POLARLICHTZONE: BEWEGUNG DER EINFALLSGEBEITE]

G. Kremser, comp. *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 227–231 refs In GERMAN (See N70-27752 13-13)

Avail: CFSTI

The results of three investigations on the movements of the incidence areas of X-ray radiation, based on simultaneous balloon measurements in northern Scandinavia, are summarized. It is shown that: (1) At midnight the incidence area moves north with a velocity of 1 km/s at the beginning of the magnetospheric particle storm. At the same time, the radiation becomes softer. Sometimes the incidence area moves back again at the end of the storm. (2) After midnight there is a two-phase movement. Firstly, the incidence area spreads quickly to the east (10 km/s) and then the whole area drifts to the east at 1 km/s. The radiation becomes softer during the first phase and harder during the second phase. (3) In the morning the incidence area spreads to the south, the radiation becoming harder at the same time. Author (ESRO)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N70-26509# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

GSSLRN-1: AN AUTOMATED LEAST-SQUARES COMPUTER CODE FOR THE ANALYSIS OF PHOTOPEAK SPECTRA

G. D. Seybold Nov. 1969 50 p refs

(Contract AT(45-1)-1830)

(BNWL-1227) Avail: CFSTI

A computer code, GSSLRN-I, is presented which is utilized for evaluations and statistical determination of photopeaks in photon spectra. The code performs evaluations of photopeak spectra using as input the digitized pulse height distribution which is output from a large multichannel analyzer. Photopeaks are located, functions are fit to each real peak, and the relative intensity of each fitted peak above the background continuum is calculated. The code contains various execution options and allows the user to obtain automatic and detailed plotting of the data and the results of each fit. The code is easily adaptable for analysis of any spectra which can be adequately defined by peaks represented in analytic form. Thus, it should be useful for application in such areas as: radiochemical analysis, analysis of reactor fuel burnup, half-life determinations, geological evaluations with respect to mineral content or time periods, analysis of Mossbauer spectra and determination of elements in blood or body tissue. Author (NSA)

N70-26552 Arizona State Univ., Tempe.

AN ANALYSIS OF ERRORS IN ELLIPSOMETRY

Paul Herbert Smith (Ph.D. Thesis) 1969 108 p

Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-20803

A theoretical analysis of the problem of determining psi and Delta from instrument readings is made for two commonly used ellipsometer geometries. The significance of the different zones of measurement and the effects due to multiple internal reflections in the retardation plate are emphasized resulting in an unambiguous, exact set of formulae. The optical bandwidth of the light employed as well as several other operational parameters, such as source polarization, collimation, and prism deviation, are considered and the analysis is compared with experimental results in an effort to determine the effect of these parameters upon the overall instrumental accuracy. Finally, evidence is presented to show that muscovite mica, such as is normally employed in the fabrication of retardation plates, is a non-homogeneous substance, displaying a fine grained structure in which individual grains have slightly different crystal orientations, thus resulting in differing fast axes for different grains within a plate. Dissert. Abstr.

N70-26580*# Bowles Fluidics Corp., Silver Spring, Md.
FLUIDIC LOW SPEED WIND SENSOR RESEARCH STUDY Final Report, Oct. 1968 - Oct. 1969
V. F. Neradka and R. F. Turek Dec. 1969 81 p refs
(Contract NAS12-2038)
(NASA-CR-86352; R-12-19-69) Avail: CFSTI CSCL 14B

Two basic concepts of fluidic wind speed sensors were experimentally investigated. One concept, a cross flow configuration, operates on the principle of momentum interaction between the wind and a perpendicular air jet. The second concept, a parallel flow configuration, operates on the principle of shear interaction between the wind and a parallel air jet. The results of this investigation reveal that the parallel flow concept has the better potential for a practical instrument. It has better linearity, requires less supply pressure to measure the same maximum air speed, and it operates over a wider range with constant supply pressure than the cross flow concept. Both approaches, however, demonstrated threshold speeds less than 1 ft/sec. A demonstration model of the parallel flow configuration was built and tested over a wind speed range of 0.3 to 160 ft/sec. Good linearity over this range was achieved with a supply pressure of 5 psig. Author

N70-26582*# Midwest Research Inst., Kansas City, Mo. Physic Section.
DEVELOPMENT OF UHF MEASUREMENTS
Charles M. Gosselin and George A. Beitel Washington NASA May 1970 61 p refs
(Contract NAS1-8730; MRI Proj. 3266-C)
(NASA-CR-1600) Avail: CFSTI CSCL 14B

Ultrahigh vacuum measuring techniques employing both the buried collector and the orbitron gauge designs have been studied. These studies include the determination of the limiting background currents to the ion collector, pressure to ion collector current response and the effects of varying the operational parameters on the gauge response. Also, a calibration technique employing a combined pressure ratio and pressure reference transfer technique is proposed for pressure calibration into the 10(- 14) torr range. Author

N70-26596 National Lending Library for Science and Technology, Boston Spa (England).
MEANS FOR DETERMINING THE MAGNITUDE AND LOCATION OF UNBALANCE IN SPHERICAL ROTORS [USTROISTVO LYA OPEDELENIYA VELICHINY I MESTA DISBALADNSA SHRAROVYKH ROTOROV]
V. M. Suminov et al Feb. 1970 4 p Transl. into ENGLISH from Russian Patent No. 213394
(NLL-RTS-5480) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

A device is described for dynamic balancing of spherical rotors in gyroscopic instruments. The indicator of the device is coupled in a comparison circuit with a continuous wave laser whose optical axis is parallel to the rotation axis of the rotor and tangential to the rotor surface. A light signal from a generator is coupled through a light energy transducer and a control circuit to a pulsed laser with Q-spoiling, a defocussed beam of light from which is directed through an aperture in the rotor chamber onto the rotor surface. R.B.

N70-26598*# Research Triangle Inst., Durham, N.C. Engineering and Environmental Sciences Div.
DESIGN, FABRICATION, TESTING AND EVALUATION OF A CHEMILUMINESCENT OZONE METER Final Report
J. B. Tommerdahl (Ph.D. Thesis) Feb. 1970 105 p refs
(Contract NAS1-9266)
(NASA-CR-66913) Avail: CFSTI CSCL 14B

An ozone meter has been developed which operates on the chemiluminescent principle. When ozone reacts with certain organic compounds, the reaction produces a minute luminescence in the 5800 A region which can be measured by means of a sensitive photomultiplier tube and dc amplifier. The chemiluminescence principle for ozone measurement, has the advantage of being essentially specific for ozone for the expected concentrations of other pollutants. A comprehensive engineering description of the design, construction details, calibration techniques and operational characteristics of the ozone meter is presented. Tests were conducted to determine the effect of Cl2. In addition, the operation and calibration at reduced pressures (specifically 10 psi) was determined. Author

N70-26603# Wisconsin Univ., Madison. Dept. of Physics.
TL VS R IN LiF: A PROPOSED MATHEMATICAL MODEL
J. R. Cameron and D. W. Zimmerman [1969] 13 p refs
(COO-1105-102) Avail: CFSTI

Correlations are presented between a model assuming the creation of traps by irradiation, and thermoluminescence measurements on TLD-100 and H63A LiF powders. Excellent agreement was found between the model and the data over the range 1 to 500,000 R. NSA

N70-26612# Goteborg Univ. (Sweden). Inst. of Physics.
NEUTRON CAPTURE GAMMA-RAY STUDIES OF SILICON, TITANIUM AND ERBIUM ISOTOPES
K. C. Tripathi 1969 16 p refs
(PB-188813) Avail: CFSTI CSCL 18D

The paper gives reviews of research on neutron capture gamma ray spectroscopy using a Ge (Li) detector in combination with a single flat crystal diffraction spectrometer. The research includes gamma ray spectroscopy of erbium, calcium, titanium, and silicon isotopes. USGRDR

N70-26617# California Univ., Livermore. Lawrence Radiation Lab.
FORTRAN CODE FOR ANALYSIS OF OPTICAL ROTATORY DISPERSION DATA
Walter H. Martin, Jr. 8 Aug. 1969 10 p refs
(UCRL-50729) Avail: CFSTI

A Fortran code has been developed for the processing of optical rotatory dispersion data from a spectropolarimeter. The program is designed to run under the Monitor system of the CDC 6600 computer. It applies the Moffitt equation to derive the constants describing helical content and helical conformation, and thus provides a way to follow transitions in solution of proteins and polypeptides. Author (NSA)

N70-26618# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
PROGRAM DOS, NSP-874, A FORTRAN 4 PROGRAM TO COMPUTE THE FLUX OR SPECIFIC ACTIVITY ASSOCIATED WITH A DOSIMETER
N. R. Baumgardt and W. B. Henderson Dec. 1969 34 p refs
(Contract AT(40-1)-2847)
(GEMP-729) Avail: CFSTI

DOS is a FORTRAN IV program written for the GE-635 computer to deduce the local neutron flux per reference power level which will produce the measured activity of a dosimeter. The dosimeter may have been irradiated in as many as 100 power cycles, each of which may have been at a different power level. Alternatively, if the flux value is supplied, the corresponding dosimeter activity will be calculated. The types of dosimeters treated are those in which neutron irradiation of the parent isotope leads to a ground state and a metastable state of the radioactive daughter, or to a ground state only. Author (NSA)

N70-26649# European Organization for Nuclear Research, Geneva (Switzerland).
THE CPS IONIZATION BEAM SCANNER (IBS)
C. D. Johnson and L. Thorndahl 9 Jul. 1968 21 p refs
(MPS/Int.CO-68-13) Avail: AEC Depository Libraries

Following some early model studies, a non-destructive residual-gas ionization proton beam scanner for the CPS ring was constructed and installed in s.s. 12 at Easter 1968. Deriving a signal from the electrons liberated by the proton beam from the residual gas of the vacuum chamber, and using a crossed electric and magnetic fields system of electron collection, the scanner gives proton density distributions in the horizontal plane with a spatial resolution of better than 1 mm. Six weeks of trials during normal CPS operation and also during some machine development periods yielded many interesting results. A full description of the principles of the device, its construction, performance, and some proposals for its future use are presented. Author (NSA)

N70-26658# Massachusetts General Hospital, Boston. Physics Research Lab.
POSITRON SCANNING WITH COMPUTER INTERFACE
Technical Progress Report, 1 Jan. – 31 Dec. 1969
Gordon L. Brownell 31 Dec. 1969 28 p refs
(Contract AT(30-1)-3937)
(NYO-3937-1) Avail: CFSTI

The development of a hybrid positron camera with a PDP-9 data processing system is outlined. Also, developments at the 6-MeV deuteron cyclotron are discussed including production and labelling studies of oxygen-15, nitrogen-13, and carbon-11. Biological application of short-lived radioisotopes are briefly considered, and a brief description of the computer interface and image processing and display system is given. NSA

N70-26667# California Univ., Berkeley. Lawrence Radiation Lab.
COMPUTER ANALYSIS OF SPECTRA
C. Michael Lederer Sep. 1969 55 p refs Presented at the Intern. Conf. on Radioact. in Nucl. Spectry., Nashville, 11 – 15 Aug. 1969
(Contract W-7405-eng-48)
(UCRL-18948; CONF-690818-9) Avail: CFSTI

Computers have contributed greatly to automation in the analysis of multichannel spectra and, more importantly, to the accuracies which can be achieved. The fundamental part of most spectral analysis methods (peak-shape analysis) is reviewed with emphasis on the present and potential level of accuracy in the determination of energies and intensities. The methods are illustrated with analyses of Ge(Li) gamma-ray spectra, although the techniques are quite general for high-resolution, multichannel spectra. It is found that gamma-ray energies can be determined to a few eV if suitable standards are available. Measurement of intensities to better than the present best error level of 1 to 2% seems possible. The resolution of closely spaced multiplets can be done far more accurately than by graphical techniques. Less basic problems pertaining to specific applications, such as automatic peak identification and grouping of peaks for fitting, are discussed less critically; some examples of programs in current use are given as illustrations. Author (NSA)

N70-26685# Akademiya Nauk URSR, Kiev.
POSSIBILITY OF USING ULTRASONIC FLOWMETERS FOR MEASURING COAL SLURRIES
V. A. Voronov, V. N. Kondo-Mikhaylov, and N. I. Sorokin *In its* Appl. Acoustics and Vibration Technol. 1968 p 64 – 70 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

It is demonstrated that by placing ultrasonic radiators and receivers in the flow of coal slurries, the basic composition of the slurry can be measured. Tests show that the slurry is a three-component mixture of air, water, and solid. Random changes by time of the amount of suspended air and solid cause measureable changes in ultrasonic velocity. Formulas describing the action of several types of flowmeters are presented. Methods for determining ore concentration errors are discussed. Since temperatures at enriching plants do not vary sharply within seasonal limits, the basic source of error is the ore concentration error. Thus, ultrasonic flowmeters can be used to control coal slurries by automatic compensation of the indicated error. Transl. by H.W.

N70-26686# Akademiya Nauk URSR, Kiev.
INFRARED PRESSURE RECEIVER
R. M. Gruzintsev, A. I. Linetskiy, and M. L. Fish *In its* Appl. Acoustics and Vibration Technol. 1968 p 71 – 76 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

A linear chemotronic pressure receiver operating at infrared frequencies is described. The receiver is suitable for wide application in meteorological, geophysical, and oceanological research. It can be used for detecting insignificant changes of atmospheric or bottom pressures, for studying low frequency atmospheric noise, and also for other studies in the frequency band. Transl. by H.W.

N70-26687# Akademiya Nauk URSR, Kiev.
METHODS OF INCREASING THE EFFICIENCY OF AN ELECTRODYNAMIC SOURCE OF ELASTIC WAVES DURING GEOACOUSTICAL PROSPECTING
V. V. Koshevoy and V. N. Parvushin *In its* Appl. Acoustics and Vibration Technol. 1968 p 77 83 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

Using the method of electromechanical analogies, the operation of an electrodynamic vibrator which radiates elastic oscillations into a rock massif is analyzed. The effect of the electrical and mechanical elements on the efficiency of the radiator is also analyzed. Transl. by H.W.

N70-26688# Akademiya Nauk URSR, Kiev.
METHOD OF MEASURING THE TIME DAMPING OF OSCILLATORY PROCESSES IN STRUCTURES AND MECHANISMS
G. S. Lyubashevskiy and B. D. Tartakovskiy *In its* Appl. Acoustics and Vibration Technol. 1968 p 84 91 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

A device is described for observing the rectified envelope of an exponential or near-exponential damping process on an afterglow oscillograph screen. By comparing the envelope to a standard straight line the direct time constant of the envelope of the oscillation process under study is determined. The frequency range of measurement is 10 to 30 Hertz. Transl. by H.W.

N70-26701# Joint Publications Research Service, Washington, D.C.
GYROSCOPES: PRODUCTION AND RESEARCH
G. A. Slomyanskiy 17 Feb. 1970 185 p refs Transl. into ENGLISH of the book "Giroskopy: Proizvodstvo i Issledovaniye" Moscow, Izd. Mashinostr., 1969 p 1 – 188
(JPRS-49860) Avail: CFSTI

CONTENTS:

1. METHODS OF CONTROLLING INSTRUMENT CONTAMINATION S. A. Kondratyuk p 6 – 38 refs (See N70-26702 13-15)

2. PROBLEMS OF MANUFACTURING TECHNOLOGY FOR PRECISION GYROSCOPIC DEVICES V. A. Berezentsev p 39 – 47 ref (See N70-26703 13-15)

3. SOME MEANS OF IMPROVING THE ACCURACY OF INTEGRATING FLOATING GYROSCOPES I. L. Milaykovskiy p 48 – 74 refs (See N70-26704 13-14)

4. EFFECT OF STRUCTURAL-TECHNOLOGICAL FACTORS ON THE QUALITY OF GYROMOTORS FOR PRECISION GYRO DEVICES A. V. Agapov p 75 – 95 refs (See N70-26705 13-14)

5. INVESTIGATION OF THERMAL DISPLACEMENTS OF THE CENTER OF GRAVITY OF GYROMOTORS FOR PRECISION

INSTRUMENTS G. A. Slomyanskiy et al p 96–114 refs (See N70-26706 13-14)

6. A METHOD OF REDUCING THE READY TIME OF GYRO DEVICES G. A. Slomyanskiy et al p 115–121 (See N70-26707 13-14)

7. MEASURING THE AXIAL VIBRATION OF RAPIDLY ROTATING RADIAL THRUST BALL I. A. Baranov et al p 122–128 ref (See N70-26708 13-15)

8. EXPERIMENTAL DETERMINATION OF THE AXIAL MOMENT OF INERTIA OF A GYROMOTOR ROTOR S. S. Zakharov p 129–152 refs

9. UNIVERSAL EQUIPMENT FOR TESTING GYROMOTORS L. V. Potemkin et al p 153–165 ref

10. STUDY OF NATURAL OSCILLATION FREQUENCIES OF EQUALLY RIGID SLIDING CURRENT LEADS WITHOUT A CONTACT LUG I. A. Baranov et al p 166–169 ref

11. GYROSCOPE DRIFT FROM ASYMMETRY OF FRICTION IN CANTILEVER CURRENT CONDUCTORS WITH VIBRATION I. A. Baranov p 170–175 refs

12. POSSIBILITIES OF THE CONTACTLESS METHOD OF DETERMINING THE SCALING COEFFICIENT OF A GYROINTEGRATOR L. V. Potemkin et al p 176–182

N70-26704# Joint Publications Research Service, Washington, D.C.

SOME MEANS OF IMPROVING THE ACCURACY OF INTEGRATING FLOATING GYROSCOPES

I. L. Mileykovskiy *In its* Gyroscopes: Prod. and Res. 17 Feb. 1970 p 48–74 refs (See N70-26701 13-14)

Avail: CFSTI

The requirements for basic structural materials used in precision gyroscope devices are given. From comparison of known building materials currently in use, beryllium is shown to be most suitable. Formulas are derived for calculating the aggregate drift of the integrating floating gyroscope caused by various interference moments. R.B.

N70-26705# Joint Publications Research Service, Washington, D.C.

EFFECT OF STRUCTURAL-TECHNOLOGICAL FACTORS ON THE QUALITY OF GYROMOTORS FOR PRECISION GYRO DEVICES

A. V. Agapov *In its* Gyroscopes: Prod. and Res. 17 Feb. 1970 p 75–95 refs (See N70-26701 13-14)

Avail: CFSTI

Open and closed type gyromotors for precision gyroscope devices are considered with respect to equal rigidity, least possible intake, minimum overheating, high stability of the center of gravity, and increased reliability and service life. R.B.

N70-26706# Joint Publications Research Service, Washington, D.C.

INVESTIGATION OF THERMAL DISPLACEMENTS OF THE CENTER OF GRAVITY OF GYROMOTORS FOR PRECISION INSTRUMENTS

G. A. Slomyanskiy et al *In its* Gyroscopes: Prod. and Res. 17 Feb. 1970 p 96–114 refs (See N70-26701 13-14)

Avail: CFSTI

The thermal displacements of the center of gravity of a gyromotor with low kinetic moment for precision gyro devices are investigated on a specially-developed experimental model of a torsion-float device. The torsion-float device is a moment scale on which the effect of the weight of the measuring device with the gyromotor on the suspension axis is excluded because the measuring device floats in a liquid, with the result that the lift of the liquid completely counterbalances the weight of the float with the gyromotor. Author

N70-26707# Joint Publications Research Service, Washington, D.C.

A METHOD OF REDUCING THE READY TIME OF GYRO DEVICES

G. A. Slomyanskiy et al *In its* Gyroscopes: Prod. and Res. 17 Feb. 1970 p 115–121 (See N70-26701 13-14)

Avail: CFSTI

One of the important operating characteristics of gyro devices is their ready time, which is defined as the run time of the gyromotor. The readiness of precision gyro devices is determined not only by the run time of the gyromotor but also by the stabilization time of the position of its center of gravity, which exceeds the run time of the gyromotor appreciably. Investigations were conducted on synchronous hysteresis gyromotors (SHM) operating in a hydrogen environment to determine the possibility of reducing the time of stabilization of the position of the center of gravity. The time is reduced by feeding the SHM a voltage at the first instant of starting, boosted in one case with respect to magnitude with normal frequency and in the other case with respect to magnitude and frequency. Author

N70-26719# Michigan State Univ., East Lansing. Div. of Engineering Research.

THE BIAXIAL INTERFEROMETRIC STRAIN GAGE Final Report, 1 Mar. –30 Nov. 1969

William N. Sharpe 21 Nov. 1969 51 p refs

(Contract DAAD05-69-C-0271)

(AD-701858; BRL-CR-5) Avail: CFSTI CSCL 14/2

The extension of interferometric strain measurement to biaxial strain fields using pyramidal diamond indenters to apply the gage was examined. Indentations so applied were found to give accurate measurements of the local strain. A configuration of three hexagonal indentations permits determination of general biaxial strains. Author (TAB)

N70-26745# DBA Systems, Inc., Melbourne, Fla.

DESCRIPTION OF INSTRUMENTATION DATA ANALYSIS AND REDUCTION FOR AN ATMOSPHERIC SEEING MONITOR Final Report

Jul. 1969 84 p refs

(Contract DAAK02-68-C-0185)

(AD-701124) Avail: CFSTI CSCL 4/1

The report summarizes the results of a study program with three primary objectives: (1) Development of instrumentation to gather data on atmospheric induced stellar image shimmer, (2) record stellar image shimmer data, and (3) perform required data reduction and analysis to determine the nature and characteristics of stellar image shimmer. The report includes a description of the instrumentation and the results of laboratory and field performance evaluation tests. Author (TAB)

N70-26768# Mellon Inst., Pittsburgh, Pa.

KINETIC SPECTROSCOPY IN THE INFRARED Final Report

Robert M. Hexter and Clifford W. Hand 26 Jan. 1969 24 p refs

(Grant AF-AFOSR-976-66)

(AD-700819; AFOSR-70-0274TR) Avail: CFSTI CSCL 7/4

A rapid-scanning IR spectrometer, capable of 20,000 scans per second, was designed and constructed. This instrument was coupled to a multiple-pass flash-photolysis cell, and experiments were performed to observe the spectrum of transient species produced by photolysis. Instrumentation was also developed to measure kinetics of reactions involving transient species. The IR spectrum of CF3 free radical was observed following photolysis of CF3I, but the spectrum intensity was too low for an accurate measurement of the decay kinetics of CF3. Photolysis of O3-C2N2 mixtures led to the tentative identification of the species NCOCN and C2N2O, the

former formed by an insertion reaction of singlet oxygen atoms, and the latter by addition of oxygen atoms in the triplet state. The work is briefly reviewed and a list of the resulting publications is given. Author (TAB)

N70-26786# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Laboratorio di Elettronica.
PROPORTIONAL COUNTERS FOR MEASURING MULTIPLICATION FACTORS [CONTATORI PROPORZIONALI PER MISURE DEL FATTORE DI MOLTIPLICAZIONE]
R. Cervellati, M. Marseguerra, P. Monaci, and C. Porceddu 1969 29 p refs In ITALIAN
(RT/FI(69)13) Avail: CFSTI

A type of proportional counter is described suitable for studying the dependence of the multiplication factor upon the gas mixture. Author

N70-26788*# Martin Marietta Corp., Denver, Colo.
LOFT INSTRUMENTATION DEFINITION STUDY Final Report, 28 May - 28 Nov. 1969
28 Nov. 1969 376 p refs
(Contract NAS5-21022)
(NASA-CR-109638; MCR-69-596) Avail: CFSTI CSCL 14B

The purpose of the instrumentation systems studied is to permit engineering evaluation of the LOFT test model design with emphasis on the measurements to (1) verify the proper deployment of LOFT; (2) determine LOFT antenna contours for evaluation of expected rf performance and dynamic analysis; and (3) determine rf radiation patterns. It was concluded that (1) antenna contour can be measured to the required accuracy using a radar ranging system, a laser ranging system, or a triangulation system employing facsimile cameras; (2) of the systems studied, laser ranging is the best contour measurement system; (3) antenna radiation patterns can be measured using a transmitted signal from the ground or from a cooperative satellite; (4) lightweight temperature and force sensors suitable for LOFT antenna installation are not currently available; and (5) photography of the entire LOFT antenna cannot be done with available television cameras. Author

N70-26800*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NUCLEAR MASS FLOWMETER Patent Application
Thomas N. Marshall, Jr., inventor (to NASA) Filed 24 Mar. 1970 11 p
(NASA-Case-MFS-20485; US-Patent-Appl-SN-22320) Avail: CFSTI CSCL 14B

The flowmeter utilizes a beta source positioned upstream of a cylindrical capacitor formed by two spaced apart concentric cylindrical sections. The concentric cylindrical sections form the capacitor electrodes and they are a part of two concentric, inner and outer, tubular members which are mounted in an outer housing that is adapted to be connected into a flow line so that fluid flows through both the inner and outer tubular members. The capacitor electrodes are insulated from the tubular members by means of dielectric ring members. Means (electrometer and vacuum pump) are provided for detecting any potential difference between the two electrodes and for evacuating the space between the outer tubular member and the housing. When fluid flows through the meter beta particles attach to the fluid molecules and this flow past electrode causes it to acquire a negative charge relative to electrode. The acquired charge can be measured. The charge acquired is dependent upon the density of the fluid flowing between electrodes. NASA

N70-26804# Army Coastal Engineering Research Center, Washington, D.C.
CERC WAVE GAGES
Leo C. Williams Dec. 1969 126 p
(AD-701903; TM-30) Avail: CFSTI CSCL 14/2

CERC has used wave gages to gather prototype wave data since 1948. Two basic types of gages are now used in the field - the step-resistance staff gage and the underwater pressure-sensitive gage. CERC has developed three types of step-resistance staff gages - a series type for use in fresh water, a parallel type for use in salt water, and a relay-operated type for use in either fresh or salt water or in water where wide changes in salinity occur. The pressure gage can be used in water of any salinity. The series and parallel gages have an accuracy of plus or minus 5 percent plus the spacing of one sensor increment. The relay gage has an accuracy of plus or minus 2 percent plus the spacing of one sensor increment. The accuracy of the pressure-sensitive gage is not as precise as that of the step-resistance gages. The report describes each gage and the theory of operation, details of fabrication, steps for calibration and installation, and requirements of maintenance. Author (TAB)

N70-26808*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MULTIPLE IMAGE STORING SYSTEM FOR HIGH SPEED PROJECTILE HOLOGRAPHY Patent Application
Robert L. Kyrtz, inventor (to NASA) Filed 2 Feb. 1970 14 p
(NASA-Case-MFS-20596; US-Patent-Appl-SN-7867) Avail: CFSTI CSCL 14E

A three beam system is designed for obtaining a holographic record on film of a high speed projectile, wherein a coherent beam of radiation is divided into a reference beam, a direct signal beam, and a reflected signal beam. The reference beam is directed without modulation to a photographic plate and the direct signal beam is directed to the photographic plate after transmission by the projectile. The reflected signal beam is directed into a beam steerer which allows the synchronous tracking of the projectile with the reflected signal beam. On reflection from the projectile the reflected signal beam is incident on the photographic plate. As the included angle between the reference beam and the reflected signal beam changes, multiple images of the target will be stored in the thick emulsion of the photographic plate. NASA

N70-26814*# TRW Systems Group, Redondo Beach, Calif.
RESONANT INFRASONIC GAUGING APPARATUS Patent Application
Bernard Siegel and Seymour Lieberman, inventors (to NASA) Filed 4 Feb. 1970 20 p
(Contract NAS9-6750)
(NASA-Case-MSC-11847-1; US-Patent-Appl-SN-8497) Avail: CFSTI CSCL 14B

A gauging apparatus for determining the quantity of liquid in an enclosed reservoir containing a liquid and an ullage gas in a zero gravity environment is discussed. An enclosed gas filled cavity is connected with the reservoir through a common elastomeric diaphragm surface. Infrasonic pressure signals directed into the cavity from a variable frequency driving means cause the ullage gas and the diaphragm to resonate at a frequency proportional to the volume of ullage gas in the reservoir. The ullage volume and therefore the remaining liquid volume is proportional to the ullage gas pressure and the resonant frequency. NASA

N70-26820*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
METHOD AND APPARATUS FOR MEASURING SOLAR ACTIVITY AND ATMOSPHERIC RADIATION EFFECTS Patent Application
George G. Haroules and Wilfred E. Brown, inventors (to NASA) Filed 31 Mar. 1970 23 p
(NASA-Case-ERC-10276; US-Patent-Appl-SN-24155) Avail: CFSTI CSCL 09E

A radiometric measuring system for observing solar activity,

atmospheric attenuation, and atmospheric emission is described. Two highly directional microwave antennas are mounted side-by-side on an equatorial mount which tracks the sun. One antenna is aimed directly at the sun to provide a sun temperature and the other antenna is aimed at a slight angle to the sun antenna to provide a sky temperature reference. Signals from the two antennas are compared in a radiometric detecting system and provide information concerning solar activity and atmospheric attenuation and emission.
NASA

N70-26866# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGNING DIFFERENTIATING AND INTEGRATING GYROSCOPES AND ACCELEROMETERS
E. A. Nikitin et al 21 Oct. 1969 270 p refs Transl. into ENGLISH of the book "Porektirovanie Differentsiruyushchikh i Integriruyushchikh Giroskopov i Akselerometrov" Moscow, Mashinostroyeniye, 1969 p 1–216
(AD-700605; FTD-MT-24-200-69) Avail: CFSTI CSCL 17/7

The book covers the fundamentals of analysis and designing of differentiating and integrating gyroscopes and accelerometers and an analysis of their errors under different operating conditions is given. Simple calculation formulas for determination of the basic parameters of these instruments and also their instrumental and methodical errors are given. Depending upon the assignment of the instrument, requirements for static, dynamic, and accuracy characteristics are shown. Much attention is given description of the physical essence and causes of appearance of the examined errors.
Author (TAB)

N70-26879# Auburn Univ., Ala. Dept. of Physics.
AN OPTICAL INSTRUMENT FOR MEASURING PRESSURE WITHIN A CLOSED CYLINDRICAL QUARTZ TUBE CONTAINING XENON
Raymond F. Askew and Gordon Hughes Jan. 1970 41 p
(Contract DAAH01-67-C-2280)
(AD-701069; AMC-2280-701) Avail: CFSTI CSCL 13/1

An optical instrument for measuring the pressure within a closed cylindrical quartz tube containing xenon at absolute pressures above one atmosphere has been developed. It utilizes the relatively large variation in refractive index of xenon with pressure which results in a measurable variation of the critical angle at the quartz-to-xenon interface. The instrument permits the rapid determination of the pressure to within one atmosphere. Detailed computations regarding optimizing of parameters are included.
Author (TAB)

N70-26898# Army Engineer Topographic Labs., Fort Belvoir, Va.
RACOMS IMAGE PROCESSING MODULE 1: ENGINEER DESIGN TEST REPORT, 3 JUNE 1968–31 JANUARY 1969
Francis P. Vena Oct. 1969 44 p
(AD-701107; USAETL-TR-47) Avail: CFSTI CSCL 14/5

Report covers the results of the Engineer Design Test for the Rapid Combat Mapping System (RACOMS) Image Processing Module I. This module is utilized to produce glass diapositives as well as Mylar and paper photographic prints from aerial photography to satisfy all RACOMS requirements for such products.
Author (TAB)

N70-26950# Aeronautical Chart and Information Center, St. Louis, Mo.
COPY THROUGH PRINTING REGISTRATION SYSTEM FOR THE LITHOGRAPHIC PROCESS
Otto C. Stoessel Jan. 1970 32 p refs
(AD-701384; ACIC-TP-23) Avail: CFSTI CSCL14/5

Lithographic registration systems, Multicolor printing, Center marks 27. The paper defines the management and technical objectives established for a system which will accurately match (register) the various materials created for production of a multi-color lithographed product. It describes the punched hole and pin design concept which is the key to the registration system. The registration system described begins with preparation of the original copy and proceeds through the reproduction negative, litho plate, and litho press operations to the finished lithographic product on which a calibrated scale printed on each sheet permits direct read out of the degree of registration quality obtained.
Author (TAB)

N70-26970# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
EXHAUST MONITOR IN NEW CONSTRUCTION FOR RADIOCHEMISTRY AND ITS CALIBRATION [DER ABLUFTMONITOR IM NEUBAU FUER RADIOCHEMIE UND SEINE KALIBRIERUNG]
G Rassl Jul. 1969 20 p refs In GERMAN
(FMRB-29/69) Avail: AEC Depository Libraries

A device is described installed in the radiochemical laboratory of the Physikalisch-Technische Bundesanstalt in order to control and to record the specific activity of the exhaust air. Measurements are reported, with punctate sources of known activity which are performed and analyzed to obtain the counting efficiency as a function of the specific activity of the exhaust air and of the radionuclide under investigation. For a special proportional flow counter with methane as counting gas and with a sensitive area of 1400 sq cm (on each side half of it), doubling of the background counting rate has been evaluated at: Tl-204: .00022 nCi/cu cm; P-32: .00013 nCi/cu cm; and Ce-144: .000017 nCi/cu cm.
Author (NSA)

N70-27034# Western Ontario Univ., London. Dept. of Physics.
CALIBRATION INSTABILITIES IN THE DUAL CAVITY AND CAPACITOR REFRACTOMETERS Final Scientific Report, 1 Nov. 1967–31 Oct. 1969
Donald R. Hay and John A. Markatos Nov. 1969 56 p refs
(Contract F19628-68-C-0128)
(AD-701408; TP-8; AFCRL-69-0548) Avail: CFSTI CSCL 4/1

Sources of instability in the calibration of the dual-cavity refractometer have been examined with the aid of controlled environments and a precision hygrometer. These instabilities are due to vapour adsorption on the cavity surfaces, mean thermal expansion of the coaxial cavities, temperature differential between the open and evacuated cavities, and perturbation of the temperature of the sampled air by the open cavity. Corrections for each of these are given, together with a computing program that permits the present refractometer to indicate air refractivity within the design accuracy. Suggestions are given for use of new materials in the cavities to simplify the analysis of the refractometer signal. The capacitor refractometer has been reconstructed in a form that embodies the recommendations of earlier investigation, in order to minimize errors due to vapour adsorption, mechanical and thermal instabilities.
Author (TAB)

N70-27051# Cornell Aeronautical Lab., Inc., Buffalo, N.Y. Aerodynamic Research Dept.
THE CAL SHOCK-TUBE-DRIVEN MOLECULAR BEAM: TARGET BEAM AND MASS SPECTROMETER Final Scientific Report, Dec. 1968–Nov. 1969
George T. Skinner Nov. 1969 35 p refs
(Contract AF 49(638)-1490)
(AD-701444; CAL-RM-2028-A-2; AFOSR-70-0070TR) Avail: CFSTI CSCL 14/2

The development of an intermittent target beam system for use in conjunction with the CAL shock-tube-driven molecular beam is reported. The beam is 1 inch in diameter and has a density of approximately 4 x 10 to the 12th particles/cu cm. A room-temperature source is used. The operation of a mass spectrometer in the environment of a 2.14 ev argon beam has also been studied and it has been found necessary to employ extensive shielding of the instrument from residual ionization, radiation and background scattering.
Author (TAB)

N70-27085# Nijmegen Univ., (Netherlands).
PROCEEDINGS OF THE INTERNATIONAL COLLOQUIUM ON PEPR
1968 142 p refs Conference held at Nijmegen Univ., 5–7 Jun. 1968
(CONF-680628) Avail: AEC Depository Libraries

The development and operation of Precision Encoding and Pattern Recognition (PEPR) systems and related equipment are discussed. These include the PEPR systems at M.I.T., Yale, Oxford, Nijmegen, Argonne National Lab., Princeton, and Ferranti Ltd. N.E.N.

N70-27090# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
FAST TRANSISTORIZED TIME-TO-AMPLITUDE CONVERTER
V. Hulubei and M. Omelianenko 1969 14 p refs
(IFA-NR-29) Avail: AEC Depository Libraries

A time-to-amplitude converter in the nanosecond range operating on the start-stop principle for use with a scintillation counter is presented. All the elements involved in the device are discussed individually. The circuit is rather similar to the overlap in principle, but has single-valued pulse height vs time characteristics provided by the hysteresis of a tunnel diode. High switching speeds are obtained with fast diode, tunnel diode, plus u.h.f. transistor combinations, improving the timing performances. Author (NSA)

N70-27091# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
WEIGHTED CHRONOTRON FOR TIME-DIGIT CONVERSION
Monica Feran, E. Katz, and R. Papina 1969 16 p refs
(IFA-EN-11) Avail: AEC Depository Libraries

A time interval is measured by counting the integer number of periods of a delay line generator with taps at weighted intervals, iteratively swept by a START pulse. The remainder of the time interval is measured by iteratively circulating START and STOP pulses through the weighted portions of the line and successively subtracting and registering them. Author (NSA)

N70-27093# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
ON THE FADING OF RELATIVISTIC TRACKS IN K5 NUCLEAR EMULSION AT HIGH TEMPERATURE
E. M. Friedlender, J. Friedlaender, A. Marin, and R. D. Settles 1969 15 p refs
(IFA-CR-58) Avail: AEC Depository Libraries

Evolution in time of the latent image fading of relativistic tracks in K-5 emulsions is investigated at a temperature typical of exposures in high intensity pulsed magnetic fields. The fading is significantly non-exponential and strong enough to cause systematic shifts and relatively wide scatters of the estimated track parameters. Plates subjected to preheating show a more regular and hence predictable fading behavior, as well as a weaker overall fading. Author (NSA)

N70-27177*# Fairchild Camera and Instrument Corp., Syosset, N.Y. Space and Defense Systems Div.
THREE-INCH MAPPING CAMERA Study Report
[1969] 245 p refs
(Contract NAS9-10201)
(NASA-CR-108414) Avail: CFSTI CSCL 14E

The requirements peculiar to the installation of the mapping camera subsystem (MCS) in the Service Module are identified for the Apollo Lunar Exploration Program. Specifications are documented for MCS end item, cartographic lens, stellar lens, and EMI control and test for the subsystem and ground support equipment. Flight hardware requirements are included for installation, electrical power, P/L space, installed payload, and auxiliary data recording. Interface requirements for MCS flight hardware are listed for temperature, ground test, environmental control, telemetry, and Manned Space Flight Network; and the interface specifications are defined for integration of the MCS in the scientific instrument module. Procedures for testing the system to guarantee that the equipment supports requirements, the data reduction compatibility, Milestone charts, and synchronization of MCS experiment data with other experiment systems conclude the qualification lists. E.M.C.

N70-27188# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
MOESSBAUER SPECTROSCOPY
In its Radiochem. Analysis Sect. Feb. 1970 p 2 51 (See N70-27187 13-24)
Avail: SOD $1.25 Catalog No. C13.46:501

The design of variable temperature devices for Mossbauer spectroscopy is discussed. The devices completed include a constant acceleration interferometer-controlled Mossbauer spectrometer and a resonant detector. Improvements are cited for nonlinear least squares fitting procedures which incorporate a modified convergence criterion and the use of basic structural parameters. R.B.

N70-27190# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
NUCLEAR INSTRUMENTATION
In its Radiochem. Analysis Sect. Feb. 1970 p 89 105 (See N70-27187 13-24)
Avail: SOD $1.25 Catalog No. C13.46:501

A constant acceleration Mossbauer spectrometer is described which uses an interferometer to sense and control velocity. Circuit diagrams are given for the five component parts of the spectrometer, consisting of the drive electronics, optical interferometer, frequency ratio detector, frequency synthesizer and control logic, and the drive transducer. R.B.

N70-27192# Florida Univ., Gainesville. Dept. of Chemistry.
AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF FLAME SPECTROMETRIC METHODS AND GAS CHROMATOGRAPHIC DETECTORS Final Scientific Report, 1 Nov. 1965 – 31 Oct. 1969
James D. Winefordner 1 Feb. 1970 22 p refs
(Grants AF-AFOSR-1033-66; AF-AFOSR-1033-67; AF-AFOSR-1885-69)
(AD-701095; AFOSR-70-0350TR) Avail: CFSTI CSCL 14/2

The research performed during the four year period is reviewed. The four major areas of research included an investigation of the fundamental, instrumental, and methodlogical (applications are included) studies in atomic emission, atomic absorption, and atomic fluorescence flame spectrometry and of the development of selective gas chromatographic detectors. All studies, whether fundamental, instrumental, or methodological, were directed toward the goal of improved methods of trace analysis of elements and molecules in gases and solutions. Author (TAB)

N70-27199*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ACCELEROMETER CALIBRATION IN THE LOW g RANGE BY MEANS OF MASS ATTRACTION
Konrad Reinel 28 Jul. 1969 55 p refs
(NASA-TM-X-53857) Avail: CFSTI CSCL 14B

Mass attraction is used as an equivalent acceleration input to calibrate an accelerometer. The upper limit of the acceleration by a reasonable mass size is 10 to the minus 9 g in orbit and 10 to the minus 7 g in the laboratory. Laboratory calibration was carried out for an electrostatic suspended single-axis accelerometer with a variable mass attraction. The mass attraction input to the accelerometer was a sine wave with an amplitude of 23 nano g. The response of the accelerometer to this acceleration input by mass attraction was obtained by data analysis and data reduction

with a computer. The results of the experiment agree with the scale factor of the accelerometer for higher acceleration inputs. Application of the mass attraction principle as a calibration method of accelerometers for very low accelerations is proposed. Author

N70-27212# Sandia Corp., Albuquerque, N. Mex.
PROBLEMS USING MIE SCATTERING PHOTOMETERS FOR IN-PLACE HEPA FILTER TESTS AND AEROSOL STUDIES
C. P. Skillern Jan. 1970 25 p refs
(SC-TM-70-15) Avail: CFSTI

Three commercially available instruments that use Mie light scattering were studied; two forward light scattering aerosol photometers, and a right-angle scattering particle counter. Standard calibration aerosols may be different from aerosols encountered at test locations, though made to appear similar by the instrument measurements. Modifications to the right-angle scattering particle counter, necessary to adapt it to the high dust loadings in studies other than aerosol-free environments, cause substantial errors in the measured particle size distribution. Frequent checking by optical and electron microscopy is essential to identify the actual particle-size distribution of the aerosol. Author (NSA)

N70-27263# Joint Publications Research Service, Washington, D.C.
ACCURACY OF RESULTS OF PHOTOGRAPHIC OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES
A. M. Lozinskiy *In its* Bull. of Opt. Artificial Earth Satellite Tracking Sta. 11 Mar. 1970 p 6-9 refs (See N70-27252 13-13)
Avail: CFSTI

Photographic determinations of stellar positions give an accuracy of tenths of an arc second. Stellar parallaxes are determined with an accuracy up to several hundredths of a second. The necessity of careful investigation of all errors arising in each type of camera during photographic determinations of satellite positions is shown. Author

N70-27304# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
DESCRIPTION OF A DEVICE FOR THE DETERMINATION OF THE FLIGHT CHARACTERISTICS OF A DO 27 AIRCRAFT WITH THE AUTOMATIC STABILITY CONTROL SYSTEM LEAR L5 [BESCHREIBUNG EINER MESSANLAGE ZUR ERFASSUNG DER FLUGEIGENSCHAFTEN EINES FLUGZEUGES DO 27 MIT EINGEBAUTEM FLUGREGLER LEAR L5]
Achim Schreier Nov. 1969 23 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-69-22) Avail: CFSTI

In order to measure the frequency response of a DO 27 aircraft with a Lear L5 automatic stability control system, the control surfaces were subjected to sinusoidal oscillations. The test devices developed to impose the oscillation and to measure the output are described. Author (ESRO)

N70-27320*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A METHOD OF TREATING THE NON-GREY ERROR IN TOTAL EMITTANCE MEASUREMENTS
J. B. Heaney and J. H. Henninger Jan. 1970 23 p refs
(NASA-TM-X-63903; X-713-70-28) Avail: CFSTI CSCL 14B

In techniques presently available for the rapid determination of total emittance, the sample is generally exposed to surroundings that are at a different temperature than the sample's surface. When the infrared spectral reflectance of the surface is spectrally selective, an error is introduced into the total emittance values so determined. Surfaces of aluminum overcoated with oxides of various thicknesses fall into this class and are often used as temperature control coatings on satellites which requires that their emittances be accurately known. The magnitude of the error was calculated for Alzak and silicon oxide coated aluminum and is shown to be dependent on the thickness of the oxide. The results demonstrate that because the magnitude of the error is thickness dependent, it is generally impossible or impractical to eliminate it by calibrating the measuring device. Author

N70-27324*# General Electric Co., Philadelphia, Pa. Missiles and Space Div.
METEOROID HAZARDS IN DEEP SPACE Final Report
S. Chandra, S. Neste, R. Soberman, and G. Zomber 1 May 1970 110 p refs
(Contract NAS9-8104)
(NASA-CR-108448) Avail: CFSTI CSCL 17H

The detection and measurement of meteoroid hazards in deep space is studied to overcome the weight and detection threshold limitations of impact sensors by using an optical system based on reflected sunlight. The objectives of the design study are listed as: (1) formulation of the equations for a Sisyphus system, (2) analytical consideration of a Sisyphus system consisting of two operating optical detection systems, (3) performance of optical tests, and (4) investigation of problems caused by low signal to noise ratios. It is concluded that the tri-optic measurement of small illuminated moving particles is practical, and it is recommended that flight qualified hardware be built to obtain much needed information of meteoroid matter and flux in support of space probes and manned space programs. F.O.S.

N70-27343*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROCKET INSTRUMENTATION DATA ASTROBEE 1500 FLIGHT 16.06 GR
William B. McAlister and Thomas E. Thompson, Jr. Mar. 1970 134 p
(NASA-TM-X-63904; X-721-70-66) Avail: CFSTI CSCL 22B

A compilation of instrumentation information is presented, including plotted data and curves, for the Astrobee 1500 rocket, Flight 16.06 GR. Included, is a compilation of data from calibration checks on various components, at the factory; and component and system tests, both at Goddard Space Flight Center and at the rocket launch site. The purpose is to present the rocket instrumentation test-data tolerances and accuracies, furnish a record of the instrumentation systems and their orientations, and to supply the necessary calibration data to be used in the reduction of post-flight data. Author

N70-27354*# Translation Consultants, Ltd., Arlington, Va.
APPLICATION OF ELECTRET MICROPHONES FOR MEASUREMENT OF PRESSURE FLUCTUATIONS ON AERODYNAMIC PROFILES [APPLICATION DES MICROPHONES A ELECTRETS POUR LA MESURE DE FLUCTUATIONS DE PRESSION SUR DES PROFILS AERODYNAMIQUES]
Bernard Baerd et al. Washington NASA May 1970 7 p refs Transl. into ENGLISH from Rech. Aerospatiale (Paris), Nov.-Dec. 1969 p 54-56
(Contract NASw-2038)
(NASA-TT-F-13004) Avail: CFSTI CSCL 14B

Study of the problem of perfecting a pressure measurement technique for thin aerodynamic profiles in a range from 10 to 1000 pA, and a frequency band of 20 to 5000 Hz. Advantage is taken of the possibilities of the electret effect to develop a microphonic pickup meeting the requirements of ease of operation, relative insensitivity to vibration, small thickness, robustness, and moderate price. Author

N70-27355 Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
MOVEMENT OF AN ASTATIC GYROSCOPE MOUNTED IN A UNIVERSAL SUSPENSION JOINT SUBMITTED TO FORCED ROTATION [ALLURE DU MOUVEMENT D'UN GYROSCOPE ASTATIQUE MONTE DANS UNE SUSPENSION A LA CARDAN SOUMISE A UNE ROTATION FORCEE]
L. I. Kargou et al. [1969] 11 p refs Transl. into FRENCH from Izv. Vyschikh Uchebn. Zavedenii Prioborstr., no. 1, 1968 p 77–81 In FRENCH and RUSSIAN
Avail: Issuing Activity

It is shown that forced rotation of a universal suspension joint produces not only a build-up to the mean value of the effect of the moments contributing to the rotation but also gives rise to artificial conservative forces which give the gyroscope vertical properties or those of a gyroscopic compass. These forces tend to align the axis of the gyroscope along the direction of the forced rotation. For this reason this type of gyroscope can only be used to obtain the angular position of a reference platform. ESRO

N70-27361# Landessternwarte auf dem Koenigstuhl, Heidelberg (West Germany).
HELIOS ZODIACAL LIGHT PHOTOMETERS: OPTICAL AND MECHANICAL CONCEPT [HELIOS-ZODIAKLLICHT-PHOTOMETER: OPTISCHER UND MECHANISCHER AUFBAU]
C. Leinert and E. Pitz Feb. 1970 76 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-70-09) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich; 15.50 DM

The optical and mechanical concept of the Helios zodiacal light photometers are described. A study of the individual components shows that an adequate reduction in light scattering is possible by suitable adjustment of the photometer in the probe, construction of the shutter system and the selection of the optical elements. In the mechanical assembly component possibilities resting on weight limit and which successfully pass mechanical tests, are given. Author (ESRO)

N70-27387# Signals Research and Development Establishment, Christchurch (England).
WAVELENGTH CALIBRATION OF MONOCHROMATORS IN THE 0.3 TO 2.0 MU REGION
R. W. Clarke, A. F. J. Cox, and J. M. Williams Sep. 1969 15 p ref
(SRDE-69042) Avail: CFSTI

A procedure is described whereby a monochromator can be calibrated between 0.3 and 2.0 micron using a combination of mercury standard spectral lines and Edser Butler fringes. The method is of general applicability but is most pertinent to prism instruments. For these instruments the numerical method outlined is more accurate and simpler than the analytical solutions derived elsewhere. Author (ESRO)

N70-27404 Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
GRAPHIC-ANALYTIC METHOD FOR DETERMINING THE PARAMETERS OF THE CONTRAST TRANSFER FUNCTION OF A PHOTOGRAPHIC EMULSION [METHODE GRAPHO-ANALYTIQUE DE DETERMINATION DES PARAMETRES DE LA FONCTION DE TRANSFERT DE CONTRASTE DES SURFACES SENSIBLES]
G. G. Gribakine [1969] 6 p refs Transl. into FRENCH from Journal de Phot. et de Cinematog., JNPFK, v. 7, no. 5, 1962 p 390–391
Avail: Issuing Activity

A method designed to measure the parameters of the contrast transfer function of a photographic emulsion using both graphical and analytic processes is described. ESRO

N70-27438# Block Engineering, Inc., Cambridge, Mass.
FURTHER INVESTIGATIONS OF ROCKET LAUNCH-PHASE INSPECTION TECHNIQUES, VOLUME 1 Summary Report
Merle J. Persky, James W. Kauffman, and James P. Moran Jan. 1969 48 p
(Contract ACADA/ST-132)
(AD-701255; ST-132/R-36) Avail: CFSTI CSCL 17/8

An investigation into the use of passive, optical techniques for arms control inspection of rocket testing is discussed. The purpose of the program and the approach used are reviewed, and an illustrative actual arms control inspection is described. The work summarized in the report included the fabrication and assembly of a comprehensive, mobile, optical instrumentation system, its use at several missile test ranges for remote (approximately one mile) measurements and the analysis of selected data. Author (TAB)

N70-27471# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
MOESSBAUER EFFECT USING BACKSCATTER GEOMETRY AS APPLIED TO NONDESTRUCTIVE TESTING
R. N. Ord Dec. 1969 34 p refs
(Contract AT(45-1)-1830)
(BNWL-1276) Avail: CFSTI

A Mossbauer effect spectrometer using a backscatter geometry was developed which is capable of over 185% peak resonant signal to nonresonant background. This high percentage effect reduces the radiation counting time to minutes as compared to hours using conventional methods and leads the way to valuable nondestructive techniques. This improvement was achieved primarily by special shielding procedures and increased source intensity matched to an appropriate gas-filled proportional counter detector. Cobalt-57 is used as the source material; however, the technique can be applied to other Mossbauer elements. A number of spectra are shown for different applications in such fields as surface physics, geology and metallurgy. Author (NSA)

N70-27478# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France).
STUDY OF KERR CELL SHUTTERS [ETUDE D'OBTURATEURS A CELLULE DE KERR]
Michel Andre and Philippe Haas Feb. 1970 55 p refs In FRENCH; ENGLISH summary
(CEA-R-3927) Avail: CFSTI

This report is devoted to the study of the Kerr effect used for producing ultra high-speed shutters. The Kerr effect is first considered from a theoretical angle and the principles of a Kerr cell shutter designed to obtain exposure times from 10 nsec to 1 msec are described. Optical measurements carried out on three shutters of different design and technical problems arising during the construction of a Kerr cell are discussed. Increasing the performance of a shutter and optimizing its operation under different conditions of use are also considered. Author (ESRO)

N70-27498# Argonne National Lab., Ill.
SYSTEM FOR MEASURING SODIUM LEVEL IN EBR-2
James B. Waldo and Lynn J. Christensen Oct. 1969 16 p refs
(Contract W-31-109-eng-38)
(ANL-7623) Avail: CFSTI

A system for measuring the level of liquid sodium has been designed and fabricated, and has been tested in the EBR-II primary tank. The transmitter of the system consists of a partially submerged buoyancy cylinder hanging from a force transducer. A stainless steel bellows is used as a gas seal. The system, which has a measuring range of 20 in., demonstrated an accuracy of + or – 1/4 in. during six months of test operation in the primary tank. It provides readout, and high- and low-level alarms and trips. Author (NSA)

N70-27507 Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
STABILITY OF A GYROSCOPE IN TURNING FLIGHT TAKING INTO ACCOUNT THE MOMENTS OF INERTIA OF THE RINGS OF THE UNIVERSAL SUSPENSION JOINT [STABILITE D'UN GYROSCOPE EN VIRAGE COMPTE-TENU DES MOMENTS D'INERTIE DES ANNEAUX DE LA SUSPENSION A LA CARDAN]
A. P. Medvedev [1969] 12 p refs Transl. into FRENCH from Izv. Vyschikh Uchebn. Zavedenii Priborostr., no. 6, 1968 p 65–69 In FRENCH and RUSSIAN
Avail: Issuing Activity

The stability in turning flight of a gyroscope, mounted in a universal joint with a centering spring, was studied using Liapunov and Tchetaév methods. The moments of inertia of the suspension rings are taken into account. ESRO

N70-27516# Nuclear Materials and Equipment Corp., Lewiston, N.Y. Niagara Div.
CASCADE INSTRUMENTATION
J. J. Hoynacki and K. E. Fersch 28 Nov. 1969 14 p
(Contract AT(40-1)-3292)
(NUMEC-3292-13) Avail: CFSTI

The new process control instrumentation package installed at the Boron Isotope Separation Facility is briefly described. NSA

N70-27584*# Department of Agriculture, Washington, D.C. Research and Development Branch.
RELATIONSHIP OF FILM OPTICAL DENSITY TO YIELD INDICATORS
Donald H. Von Steen, Ross W. Leamer, and Alvin H. Gerbermann [1969] 18 p
(NASA Order W-12996)
(NASA-CR-109836) Avail: CFSTI CSCL 14E

Statistically significant relationships were found between certain preharvest yield indicators and film densities of aerial infrared film in micro experiments. These studies suggest a fixed relationship may exist for important yield components which makes it possible to estimate crop yields with remote sensing techniques. Cotton, grain sorghum, carrots, cabbage, and onions were included in the study. Ground data from small plots improve the estimates made from film density measurements. Author

N70-27587# Bonn Univ. (West Germany). Inst. fuer Physikalische Chemie.
STIMULATION OF PHYSICO-CHEMICAL PROCESSES. PART 4: MEASUREMENT OF WEAK LIGHT INTENSITIES BY PHOTON COUNTING. [SIMULATION VON PHYSIKALISCH-CHEMISCHEN VORGAENGEN IN DER HOEHEREN ATMOSPHAERE. TEIL 4: MESSUNG SCHWACHER LICHTINTENSITAETEN DURCH PHOTONENZAEHLUNG]
K. H. Becker, B. Fassbender, D. Haaks, and D. Kley Oct. 1969 27 p refs In GERMAN Sponsored by Bundesmin. fuer Bildung und Wiss. and Landesamt fuer Forsch. Des Landes Nordrhein-Westfalen
(SHA-4) Avail: CFSTI

To detect very weak light intensities one normally uses photomultipliers in which the integrated 'analog' signal is normally amplified by a DC or AC voltage amplifier. For optimal signal-to-noise ratios of this stage, a measuring device is described, which counts photomultiplier signal pulses after discrimination from interference pulses, and, by integration over a constant line-interval, makes it possible to record these pulses. ESRO

N70-27611# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
NEW SPECTROMETER FOR CHARGED PARTICLES [ETUDE D'UN NOUVEAU SPECTROMETRE POUR PARTICULES CHARGEES]
Rene Wajsfelner (Ph.D. Thesis) Feb. 1970 34 p refs In FRENCH; ENGLISH summary
(CEA-R-3940) Avail: CFSTI

This report deals with the study and development of an electrostatic spectrometer which can accurately determine the size distributions of electrically charged radioactive atmospheric aerosols and can also be used for measuring the grain-size distribution of any cloud of particles which has previously been charged according to a known reproducible law. The electrical charge on spherical polystyrene latex particles suspended in air by atomization was studied and a theoretical explanation of the results is suggested. Author (ESRO)

N70-27628 National Lending Library for Science and Technology, Boston Spa (England).
A NEW MAGNETIC OXYGEN METER WITH VERY RAPID ADJUSTMENT AND HIGH SELECTIVITY [EIN NEUER MAGNETISCHER SAUERSTOFF-METER MIT SEHR KURZER EINSTELLZEIT UND HOHER SELEKTIVITAET]
H. Hummel 23 Jan. 1970 14 p refs Transl. into ENGLISH from Chem.-Ing.-Tech. (West Ger.), v. 40, no. 19, 1968 p 947–951
(NLL-SMRE-Trans-5765-(8313.4)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The instrument measures directly and continuously the susceptibility of a gas mixture. The gas to be measured and the reference gas are introduced into the enclosed gap space of an electro-magnet, excited by an a.c. of 50 Hz, through two feed tubes. The resulting alternating pressure which is proportional to the difference in susceptibility between the two gases and is a measure of the difference in their O2 concentrations, is measured by means of a condenser microphone. The new instrument has very high indication velocity and low dependence on the composition of the carrier gas; it has, therefore, a wide range of applicability in both technical and medical investigations. Author

N70-27643# Agricultural Research Service, Philadelphia, Pa.
AN IMPROVED PEN MECHANISM FOR CERTAIN STRIP-CHART RECORDERS
A. I. Schepartz, R. R. Calhoun, and G. Pisano Oct. 1969 4 p
(ARS-73-62) Avail: Issuing Activity

A strip-chart pen mechanism is described which contains the following characteristics: (1) the pen is self-cleaning and contains a built-in cleaning plunger, (2) it requires no remote ink well or siphon line, (3) the entire pen and ink well unit can be removed and replaced easily when ink refill or complete overhaul is necessary, and (4) ink colors can be changed quickly by simply changing pens. A schematic diagram is given which shows necessary modification of existing pen sockets to accommodate the pen mechanism. Author

N70-27648# New York Univ., N.Y. Geophysical Sciences Lab.
A THRUST ANEMOMETER FOR THE MEASUREMENT OF THE TURBULENT WIND VECTOR
Gerard J. McNally Jan. 1970 52 p refs
(Contract Nonr-285(57))
(AD-701707; GSL-TR-70-1) Avail: CFSTI CSCL 4/2

An improved version of a three component thrust anemometer is discussed. The design criteria and specifications of its component parts are outlined. Results of laboratory and wind tunnel tests are described which were designed to test the static characteristics and frequency response of the anemometer as well as results of wind tunnel tests. Rotation tests performed at various wind speeds provide information on the anemometers ability to resolve the vector wind into its components. Author (TAB)

N70-27663# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
CRITICALITY DOSIMETRY FOR PLANT PERSONNEL

Merlyn R. Boss and John R. Mann 26 Dec. 1969 16 p refs
(Contract AT(29-1)-1106)
(RFP-1369) Avail: CFSTI

The personnel criticality activation dosimeter in use at the Rocky Flats Plant is an integral part of the film badge and the thermal luminescent dosimetry (TLD) badge. The system consists of a copper foil, cadmium-shielded indium foil, unshielded indium foil, and a sulfur tablet. The nuclear reactions in use are indium-151m, copper-63 (n, gamma), copper-64; and sulfur-32 (n,p), phosphorous-32. These reactions cover the energy ranges: 0 to 1.4 electron volts; 2 electron volts to 1 million electron volts; 1 million electron volts to 2.9; and above 2.9 million electron volts. Fluence and dose calculations and the counting equipment are described.
Author (NSA)

N70-27689# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
STUDIES OF IMAGE FORMATION AND THE REDUCTION OF FIXED STARS IN SATELLITE PHOTOGRAPHS [STUDIEN ZUR ABBILDUNG UND AUSWERTUNG DER FIXSTERNE IN SATELLITEN-MESSBILDERN]
Wolfgang Ahrens (Ph.D. Thesis—Tech. Univ. of Brunswick) Nov. 1969 125 p refs In GERMAN; ENGLISH summary
(Contracts RFF 24/5; RFF 2012)
(DLR-FB-69-92) Avail: CFSTI

The paper deals with problems of image formation and the reduction of fixed stars on satellite photographs. For determining a favorable exposure sequence, the influence of the exposure time and star brightness on the diameter and form of the image points was investigated and a method for the identification and marking of the fixed stars to be measured was developed. Right-angle error and scale-difference of the comparator axes were eliminated by measuring in two orthogonal positions. Observation errors and residual adjustment errors were investigated by means of statistical test methods. Mathematical correlations were found which are either due to the geometry or depend on the numerical reduction.
Author (ESRO)

N70-27703# Institute of Nuclear Research, Warsaw (Poland).
PROPORTIONAL COUNTER FOR MEASURING BETA EMITTING SOURCES OF LARGE AREA
Adam Ciarkowski 1969 16 p refs
(INR-1092) Avail: AEC Depository Libraries

The construction and important characteristics of the proportional counter enabling measurement of beta sources of large area (exceeding 120 × 150 mm) are described. The methods and results of research concerning gas amplification, distribution of efficiency of detection of beta particles emitted from various points of the measured source area, and the effect of the lack of electric conductivity between the source and the cathode are presented.
Author (NSA)

N70-27747*# Bellcomm, Inc., Washington, D.C.
PHOTOGRAPHY OF GROUND SITES FROM AAP ORBIT
D. A. DeGraaf and E. W. Radany 12 Feb. 1970 43 p
(Contract NASw-417)
(NASA-CR-109772; B70-02023) Avail: CFSTI CSCL 14E

The possibility of remaining in the solar-inertial attitude during the ground photography is explored. The existence of an adequate window in the MDA on the side way from the ATM so that the center of its field is always directly along the sun's rays is presumed. Targets outside this field of view are not well lit and were not photographed. Emphasis is placed on the orbit geometry and calculation of the viewing opportunities. Other topics discussed are optical distortions due to the window that must be guarded against and improvements in the operational procedures that would accrue from this alternate method.
Author

N70-27758# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
THEORY AND PRACTICE OF AN IMPROVED RADIO FREQUENCY IMPEDANCE PROBE FOR EXTRATERRESTRIAL ELECTRON DENSITY MEASUREMENTS [THEORIE UND PRAXIS DER VERBESSERTEN HOCHFREQUENZ-IMPEDANZSONDE FUER EXTRATERRESTRISCHE ELEKTRONENDICHTE-MESSUNGEN]
F. Melzner and H. H. Rabben *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 21-28 refs In GERMAN; ENGLISH summary (See N70-27752 13-13)
Avail: CFSTI

The swept radio-frequency impedance probe with a guard ring proved to be a high precision instrument for measuring the ionospheric electron density and its advantages are explained. The guard ring removes the varying influences of the ion sheath which often invalidates results. The measured frequency spectrum of the probe capacity shows a great similarity with the spectrum of the admittance of a spherical probe calculated by Balmain and Oksutik. The underlying theory is explained, and the Q of the resonances which arise in a magneto-plasma are also correctly represented for a spherical probe.
Author (ESRO)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N70-26702# Joint Publications Research Service, Washington, D.C.
METHODS OF CONTROLLING INSTRUMENT CONTAMINATION
S. A. Kondratyuk *In its* Gyroscopes: Prod. and Res. 17 Feb. 1970 p 6-38 refs (See N70-26701 13-14)
Avail: CFSTI

Construction principles are proposed for ensuring minimum contamination in high-precision instruments. Contamination of the fluid of an integrating floating gyroscope with foreign particles and contamination of the open gyromotor lubrication lead are considered in detail. Recommendations are given for ensuring cleanliness during manufacture of parts, assemblies, and finished instruments.
R.B.

N70-26703# Joint Publications Research Service, Washington, D.C.
PROBLEMS OF MANUFACTURING TECHNOLOGY FOR PRECISION GYROSCOPIC DEVICES
V. A. Berezentsev *In its* Gyroscopes: Prod. and Res. 17 Feb. 1970 p 39-47 ref (See N70-26701 13-14)
Avail: CFSTI

The adjustment of metalworking machine tools used in manufacturing parts for precision gyroscope devices is discussed. It is necessary to maintain a constant temperature environment for both the machine tools and parts to ensure precision of geometric shape and dimensions.
R.B.

N70-26706# Joint Publications Research Service, Washington, D.C.
MEASURING THE AXIAL VIBRATION OF RAPIDLY ROTATING RADIAL THRUST BALL BEARINGS
I. A. Baranov et al *In its* Gyroscopes: Prod. and Res. 17 Feb. 1970 p 122-128 ref (See N70-26701 13-14)

Avail: CFSTI

Vibration of the radial thrust bearings on which the gyromotor turns is caused by three factors: (1) the geometric and physical quality of manufacturing the bearing elements, (2) the quality of their installation in the gyromotor during assembly, and (3) the degree of their contamination. A device is described for checking the axial vibration of the bearings, which reduces the number of gyromotors rejected for vibration and indicates the cause of increased gyromotor vibration. The device can be used to compare the axial vibration of various types of ball bearings with respect to magnitude when selecting bearings for gyromotor designs. R.B.

N70-26726# Army Materials and Mechanics Research Center, Watertown, Mass.

CHEMICAL VAPOR DEPOSITION OF POLYCRYSTALLINE ALUMINUM OXIDE Technical Report

Philip Wong and Mc Donald Robinson Oct. 1969 23 p refs

(AD-701013; AMMRC-TR-69-24) Avail: CFSTI CSCL 13/8

Polycrystalline aluminum oxide was chemically vapor deposited onto sintered alumina substrates by reaction of AlCl3 with H2O, CO2 + O2, and O2 at temperatures of 1000 C and 1500 C, and pressures of 0.5 and 5.0 Torr. While the thermodynamics of all three reactions predict the formation of solid Al2O3, the deposition rate of the first reaction was considerably greater than that of the second. The third reaction was so slow that no measurable deposit was formed in six hours at 1500 C. Formation of dense deposits of the alpha-Al2O3 was favored by increasing temperature and decreasing pressure. Microstructural examination of the dense deposits showed long columnar grains, the largest of which extended through the deposit from the substrate to the surface. (Authors) TAB

N70-26801*# Hazleton Labs., Falls Church, Va.

FIREFLY PUMP/METERING SYSTEM Patent Application

Chris J. Plakas, inventor (to NASA) Filed 27 Feb. 1970 17 p

(Contract NAS5-10146)

(NASA-Case-GSC-10218-1; US-Patent-Appl-SN-15022) Avail: CFSTI CSCL 13K

A pumping and metering dual piston system for simultaneously injecting controlled amounts of sample and reactants into a reaction chamber and an enzyme into an adjacent injection chamber is described. A rotary shaft is actuated to communicate the injection chamber with the reaction chamber and to actuate a mechanism for forcing the enzyme from the injection chamber to the reaction chamber. Additionally, the shaft supports and operatively rotates detector apparatus from a magnetic and light radiation shielded position to a position for monitoring the reaction chamber constituents. NASA

N70-26806*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

BONDING OF REINFORCED TEFLON TO METALS Patent Application

Felix P. La Iacona, inventor (to NASA) Filed 28 Jan. 1970 12 p

(NASA-Case-MFS-20482; US-Patent-Appl-SN-6610) Avail: CFSTI CSCL 13H

The method is primarily adapted to the fabrication of self-lubricating composite bodies such as gear wheels having alternating layers of reinforced FEP Teflon and steel. The method comprises applying a thin, continuous coating of copper to the surface of the metal member, disposing a layer of irregularly shaped copper particles such as filings at the interface, and compressing the members together while heating to an elevated temperature. For bonding of reinforced FEP Teflon to steel a temperature of 550 F to 580 F and a pressure of 2350 to 2650 pounds per square inch can be used. A thin copper coating at the interface promotes diffusion and formation of a strong bond. Composite bodies fabricated by this method show a much higher strength and capability for service at higher temperatures than bodies fabricated by adhesive bonding. NASA

N70-26810*# Sperry Rand Corp., Philadelphia, Pa.

ISOLATION COUPLING ARRANGEMENT FOR A TORQUE MEASURING SYSTEM Patent Application

Lawrence Davis, James E. Crutcher, and Jerald H. Weidenhamer, inventors (to NASA) Filed 29 Nov. 1969 8 p

(Contract NAS1-4155)

(NASA-Case-XLA-4897; US-Patent-Appl-SN-880249) Avail: CFSTI CSCL 13E

A coupling arrangement is described for isolating the torque loads from axial, radial, and bending loads in a load path having a torque measuring transducer so as to eliminate errors in torque measurement resulting from their imposition of the transducer, while retaining substantial support for these loads. This is attained by the use of a pair of flexures connected in parallel in the load path which have complementary load bearing characteristics, a first one compliant to radial, axial, and bending loads and rigid under torque, the second having opposite characteristics, with the transducer measuring the torque carried by the first flexure. NASA

N70-26816*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HIGH SPEED ROLLING ELEMENT BEARING Patent Application

William J. Anderson and Harold H. Coe, inventors (to NASA) Filed 16 Jan. 1970 12 p

(NASA-Case-LEW-10856-1; US-Patent-Appl-SN-3417) Avail: CFSTI CSCL 13I

Bearings with reduced mass of rolling elements for operating reliably at high speed with long life expectancy are described. A cage separates and positions the rolling elements. The mass of each rolling element is reduced by a hole. Pins maintain the rolling elements in the optimum positions while limiting the free pivoting of the maximum moment of inertia axis of each rolling element. Heat generation is decreased without significantly changing any of the bearing kinematical characteristics. Lubricant acts as a coolant at high speeds as it passes through the holes. NASA

N70-26818*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DISPERSION HARDENED ALLOYS Patent Application

Alan Arias, inventor (to NASA) Filed 26 Nov. 1969 13 p

(NASA-Case-LEW-10450-1; US-Patent-Appl-SN-880271) Avail: CFSTI CSCL 13H

A relatively coarse metal powder and a dispersoid are simultaneously ground to a very fine powder and thoroughly mixed in a gas-tight mill pressurized with a hydrogen halide. The metal powder reacts gradually with the hydrogen halide forming hydrogen and the halide of the metal being milled while the mill pressure decreases. The dispersoid does not react with the hydrogen halide used for milling. The mill is periodically evacuated and repressurized with hydrogen halide when the pressure decreases sufficiently to indicate the exhaustion of the hydrogen halide. The milled powders are placed in a retort and heated in flowing hydrogen which reacts with the metal halide in the milled powders to form hydrogen halide gas and metal. This hydrogen halide gas is removed by the flowing hydrogen. The exhaust gases from the retort are analyzed for hydrogen halide to determine when the metal powders are clean. The cleaned powders are finally removed from the retort and consolidated. The dispersion hardened alloy produced has a minimum amount of undesirable impurities. The process also involves fewer steps than conventional milling methods. Author

N70-26819*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DISK PACK CLEANING TABLE Patent Application

Joseph T. Guy, Sr., inventor (to NASA) Filed 23 Mar. 1970 10 p

(NASA-Case-LAR-10590-1; US-Patent-Appl-SN-21732) Avail: CFSTI CSCL 13I

A device for removing the plastic dust cover from a digital computer disk pack for inspection and cleaning is described. The novel device utilizes a retractable ejector activated by a spring-loaded lever to trip the release mechanism for removal of the dust cover. The disk pack is placed upon the hollow, rotatable spindle for removal of the cover and cleaning. This spindle houses the retractable ejector and its rotational capability simplifies cleaning and inspection operations. Use of this device has already realized a considerable local saving in cost and time and has greatly increased efficiencies in disk pack cleaning and computer time utilization. NASA

N70-26821*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

PROCESS AND APPARATUS FOR MAKING DIAMONDS Patent Application

John R. Rasquin and Marvin F. Estes, inventors (to NASA) Filed 16 Jan. 1970 12 p

(NASA-Case-MFS-20698; US-Patent-Appl-SN-3418) Avail: CFSTI CSCL 13H

The apparatus includes an exponential horn tapering from a large end down to a small end. A copper plate is mounted against the large end of the horn and a magnetic hammer abuts the copper plate. The magnetic hammer and copper plate function to create a shock wave in the exponential horn. An anvil having a small pocket formed is mounted adjacent to the small end of the exponential horn so that the small end rests in the pocket. The anvil, horn, and hammer are all secured together and, in operation, graphite is placed in the anvil pocket. The magnetic hammer generates a shock wave in the exponential horn and because of the horn shape, which is critical, the velocity of the shock wave is amplified and the shock wave energy concentrated so that all of the energy in the shock wave arrives simultaneously at the small end of the horn. This energy is transferred to the graphite in the anvil pocket and results in pressure and temperature levels that causes the graphite to be transformed to diamonds. NASA

N70-26921# South Carolina Univ., Columbia. Coll. of Engineering.

POWDER METALLURGY COMPACTION Quarterly Progress Report, 1 Sep. -30 Nov. 1969

E. G. Schwartz, Lewis R. Goodwin, Kenneth L. Wilson, and James B. Hornsby 30 Nov. 1969 21 p refs

(Contract AT(38-1)-475)

(SRO-475-4) Avail: CFSTI

The feasibility of using porous die liners as a means of providing die wall lubrication in powder metallurgy compaction was evaluated. More specifically, a new lubricant, butyl stearate, which has flow properties in the porous die liners slightly superior to previously tested lubricants was studied. Continuous high pressure lubrication was also evaluated and compared with the intermittent lubricating procedure used previously. Further investigation was initiated in the area of die translation. Two methods are being considered; slow vertical translation during compaction, and vibration of the die during compaction. Presently the apparatus has been designed, orders placed for the required equipment, and modification work on existing equipment has begun. A continuing program of lubrication evaluation is underway. As new lubricants come to light they are tested and compared with previous lubrication data. The lubrication evaluation area also includes methods of application. Work underway to develop a method of application which will control the lubricant film thickness is described. Author (NSA)

N70-26922# Dow Chemical Co., Golden, Colo.

GAS-METAL ARC BRAZE WELDING OF INGOT-SHEET BERYLLIUM

Richard J. Merlini and Walter L. Bush 22 Oct. 1969 13 p refs

(Contract AT(29-1)-1106)

(RFP-1333) Avail: CFSTI

Discussed are studies on the gas-metal arc welding of ingot-sheet beryllium produced at Rocky Flats. The results of a weld-porosity study indicated that radiographically porous-free welds could be made if the proper welding process parameters were used. Tensile test data of welds showed that welds stronger than the base metal were easily produced if unbonding was avoided. The results of specimens tested for weld unbonding confirmed previous data from hot pressed beryllium that a fill factor of less than 10 must be used to prevent unbonding between the weld and the base metal. Graphs showing general process-parameter limits have also been constructed and are presented. Author (NSA)

N70-26982*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE OF 75-MILLIMETER-BORE BEARINGS TO 1.8 MILLION DN WITH ELECTRON-BEAM-WELDED HOLLOW BALLS

Harold H. Coe, Herbert W. Scibbe, and Richard J. Parker Washington May 1970 23 p

(NASA-TN-D-5800; E-5442) Avail: CFSTI CSCL 13I

An experimental investigation was performed with two series (115 and 215) of 75-mm-bore ball bearings using hollow balls as the rolling elements. Similar bearings using solid balls were also tested and the data compared. The bearings were tested at 500- and 1000-lb thrust loads at shaft speeds up to 24,000 rpm. The results show only slight differences in torque and outer-race temperature between the hollow ball bearings and the corresponding solid ball bearings. The 11/16-in.-(17.5-mm-) diameter AISI M-50 steel hollow balls, for use with the series 215 bearings, were tested in a five-ball fatigue tester. The resulting fatigue life was significantly less than expected. The balls failed in flexure fatigue because of a stress concentration in the weld area. Author

N70-27057# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

APPROXIMATE ESTIMATE OF FRICTION IN COMPOSITE BEARINGS

N. I. Brekhin 18 Sep. 1969 10 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 8, 1966 p 3–6

(AD-700310; FTD-HT-23-504-68) Avail: CFSTI CSCL 13/9

Ratios are given which make it possible to determine in the first approximation the friction moment in a bearing where there is a middle ring which is forced to rotate, as well as the optimum ratio of angular velocities. The forces of resistance to rolling are related to the pressure between the surfaces of the rolling bodies; there the power lost in overcoming the rolling bodies resistance is formulated. Further considerations give the general formula for total moment of friction. TAB

N70-27121# European Atomic Energy Community, Brussels (Belgium).

STAINLESS PLATING OF HIGH-GAUGE STEELS Final Report [PLACAGE INOXYDABLE D'ACIERS DE FORTES EPAISSEURS RAPPORT FINAL]

1970 61 p refs In FRENCH

(Contract EURATOM-008-63-12-TEEB)

(EUR-4013-F) Avail: CFSTI

The studies carried out indicate the superiority of the ribbon process over other plating processes. The technological and metallurgical parameters affecting the quality of the deposited metal and giving it the desired properties are defined quantitatively. A plating flux which incorporates the various findings and which represents the best possible compromise with respect to both the technological and the metallurgical requirements is developed. Principles are formulated which govern the manner of tackling and solving a plating problem and also the optimum choice of ribbon-flux combinations and the control of their use conditions. Author

N70-27194# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OSCILLATIONS OF SHAFTS ON AN OIL FILM (COLLECTION OF ARTICLES)
F. M. Dimentberg et al 17 Oct. 1969 129 p refs Transl. into ENGLISH from the Russian
(AD-700722; FTD-MT-24-226-69) Avail: CFSTI CSCL 13/7

Contents: Oscillations and stability of shafts on an oil film; Influence of the oil layer in plain bearings on the stability and critical speeds of high-speed rotors; Oscillations of a rotor on an oil film; Investigation of natural oscillations of a flexible rotor on plain bearings; Operational dynamics of flexible rotors of turbogenerators on built-in plain bearings; Investigation of the influence of elastic and damping properties of oil film on critical speeds of rotors of ship turbines; Forced oscillations of shaft leads of turbine units; Dynamics of rotor hydrostatic bearings; and Lubrication of packaging of rotors of turbogenerators; Calculation of thrust bearings and butt packings of rotors of turbogenerators; The question of the oscillation of rotors in slot packings of hydromachines. TAB

N70-27222 National Lending Library for Science and Technology, Boston Spa (England).
THE RELATION OF THE FRICTION COEFFICIENT AND DEFORMATION OF MATERIAL TO PROPERTIES AND THICKNESS OF SURFACE FILMS
P. V. Nazarenko et al 26 Jan. 1970 5 p refs Transl. into ENGLISH from Dopov. Akad. Nauk. Ukr. (Russian), v. 31, 1969 p 559 - 561
(NLL-RISLEY-Trans-1819-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The effects of film material and thickness on friction and deformation of rock salt (NaCl) crystals were investigated. Indium and germanium films were sprayed on the crystals, friction was applied by a steel indenter, and the specimens were subjected to cleavage perpendicularly to the direction of friction. The size and character of deformation were determined by chemical etching. As the film thickness was increased, the coefficient of friction decreased at first and then increased. The minimum values were reached when the film thickness was 1000 A for indium and 20-100 A for germanium. The depth and width of the dislocation zones were found to increase at first and then decrease sharply as the thickness increased. N.E.N.

N70-27279# Argonne National Lab., Ill.
MOLECULAR-BEAM DEPOSITION OF NICKEL CHLORIDE ON METAL SUBSTRATES
Ben D. Holt Jul. 1969 75 p refs
(Contract W-109-eng-38)
(ANL-7593) Avail: CFSTI

Sticking coefficients of nickel chloride on polycrystalline molybdenum, gold, and nickel were measured by exposing the metal targets, over a range of 80 to 750 K, to a molecular beam of $NiCl_2$ at 836 K. Each target, heated to a constant temperature by a radiometer-controlled electron gun, was enclosed in a liquid-nitrogen-cooled collector for the capture of molecules reevaporated from the heated surface. The total amount of $NiCl_2$ striking the target in each 90-min exposure corresponded to 30 monomolecular layers on the substrate. The coefficient versus-temperature curve differed drastically from the corresponding theoretical curve calculated on the basis of equilibrium vapor pressure and beam geometry. Whereas the theoretical coefficient changed from near unity to zero over a span of about 60 deg the experimental coefficient did so over 265 deg. Within the range of variation, the coefficient was significantly enhanced by a thin coating of $NiCl_2$ predeposited at 80 K. Author (NSA)

N70-27294*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE MANUFACTURING UNIQUE TO ZERO GRAVITY ENVIRONMENT
Hans F. Wuenscher 11 Jul. 1969 31 p refs
(NASA-TM-X-53851) Avail: CFSTI CSCL 13H

Manufacturing processes are reviewed and three categories are established: processes which work in orbit, processes which work much better in orbit, and processes which work only in orbit. Two unique process groups are discussed; buoyancy and thermal convection sensitive processes and molecular forces controlled processes. The range of recommended products includes heterogeneous radiation shielding, isotope fuels, high strength fittings, high purity reactor casings, hollow precision balls, ultra thin membranes for solid state chemistry, optical components, multilayer curved components, and controlled density materials. These products have unique new features and can be made only in extended zero g environment. Author

N70-27313*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INVESTIGATION OF THE TECHNICAL MICRONICS CONTROL (TMC) PROCESS FOR ELECTROPOLISHING VARIOUS METALS
James R. Lowery 15 Apr. 1970 19 p refs
(NASA-TM-X-64516) Avail: CFSTI CSCL 13H

The Technical Micronics Control (TMC) process for electropolishing a variety of metals and metal alloys was investigated. The electropolishing solution produced lustrous surfaces on stainless steel, brass, copper, nickel, aluminum, and steel; it produced only semi-bright surfaces on Invar and Rene 41 but produced a considerable amount of metal smoothing. The passivation of stainless steel was improved substantially by this method over that of conventional acid passivation methods. TMC polished surfaces of stainless steel, brass, and carbon steel did not accept an electroplate with good adherence but such surfaces were more resistant to tarnish or corrosion than mechanically polished surfaces. Based on results of this study, the TMC process is recommended for polishing and smoothing most metals and for passivating stainless steel. Author

N70-27446# Defense Documentation Center, Arlington, Va.
MACHINING, VOLUME 1 BIBLIOGRAPHY, NOV. 1960 - OCT. 1969
Mar. 1970 120 p refs
(AD-702650; DDC-TAS-70-19-Vol-1) Avail: CFSTI CSCL 13/8

The bibliography is a compilation of 92 annotated references on machining. Machining variables such as tool materials, tool geometry, cutting fluids, depth, feed, and tool life, as well as material groups, are discussed. Author (TAB)

N70-27556 Paris Univ. (France). Faculte des Sciences.
DESIGN AND TESTING OF A 9000 l/s TURBOMOLECULAR PUMP [ETUDE ET EXPERIMENTATION D UNE POMPE TURBOMOLECULAIRE DE 9.000 l/s]
Leonide Rubet (Ph.D. Thesis) [1969] 99 p refs In FRENCH
Avail: Issuing Activity

A turbomolecular pump which can produce an ultrahigh vacuum in a large vessel was developed. The theory of molecular pumps, outgassing, desorption, etc., are reviewed and a detailed description of the pump is given along with its performance characteristics, the results obtained with nitrogen and helium. This pump is capable of producing a vacuum of 1.4×10 to the minus 11th power torr at mass flow rates up to 9000 l/s and is thus suitable for space simulation and particle accelerator applications. It could also be used in cryogenic pumping installations utilizing wall cooling by liquid hydrogen or helium. ESRO

N70-27616 National Lending Library for Science and Technology, Boston Spa (England).
OPERATION OF A SINTERED-PLATE IRON ELECTRODE

IN ALKALINE ACCUMULATORS

E. M. Lamedman et al. 19 Jan. 1970 19 p refs Transl. into ENGLISH from Zh. Prikl. Khim. (Moscow), v. 42, no. 7, Jul. 1969 p 1586 - 1592 In RUSSIAN and ENGLISH
(NLL-Trans-746-353-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

The effect of porosity of sintered-plate iron electrodes on electrical discharge, the change of stability during cycling, and service characteristics of the electrodes were studied. Sintered-plate iron electrodes, produced by rolling spongy iron powders, were used as negative electrodes in nickel accumulators. The relation between the porosity and the specific capacity of the active mass of the sintered-plate iron electrodes was determined. The decrease of the specific characteristics of the active mass during a decrease of general porosity takes place with, and is linked with, a decrease in the amount of large pores. The application of sintered-plate electrodes improved the specific characteristics of the accumulator. It is concluded that the sintered-plate electrodes can be used in accumulators with short discharges, for example, in starter accumulators for internal combustion engines. Author

N70-27640*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF ANTIWEAR AND EXTREME-PRESSURE ADDITIVES IN A SYNTHETIC PARAFFINIC LUBRICANT ON BALL SPINNING TORQUE

Dennis P. Townsend and Erwin V. Zaretsky Washington May 1970 12 p refs
(NASA-TN-D-5820) Avail: CFSTI CSCL 11H

Tests were conducted in the spinning-torque apparatus to determine the effect of lubricant additives on the torque of a ball spinning in a nonconforming groove. The base lubricant was a synthetic paraffinic oil to which were added 0.1, 1.0, and 10 volume percent of either an antiwear or EP additive. The additives used were stearic acid, oleic acid, oleyl phosphate, oleyl phosphite, and zinc dithiophosphate. Under the test conditions, elastohydrodynamic lubrication prevailed with no significant surface interaction. The addition of the antiwear or EP additives in several concentrations to the synthetic paraffinic oil did not change the spinning torque over that obtained with the base fluid. The viscoelastic properties of the base fluid were not changed by the additives tested. Author

N70-27669*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
SOME PRACTICAL ASPECTS OF SCRIBING

Samuel M. Polcari Washington May 1970 17 p
(NASA-TN-D-5811; C-116) Avail: CFSTI CSCL 13H

The results are described of a series of experiments performed in the diamond scribing of silicon wafers for the separation of dice. The factors considered are tool depth, tool direction, tool speed, tool geometry, scribing angle, and force. The tests were made to evaluate the heel scribing approach, a relatively recent development in the scribing of silicon wafers, which utilizes the back or heel of the diamond tool rather than the front or toe of the standard truncated tool. Author

N70-27740# Bendix Corp., Kansas City, Mo.
PERCUSSIVE ARC WELDING FOR ELECTRICAL ASSEMBLIES

Edward R. Cheramy Sep. 1969 23 p
(Contract AT(29-1)-613)
(BDX-613-126) Avail: CFSTI

Percussive arc welding is discussed as a dependable, high temperature union between stranded copper wire and connector pins, and for joining stranded wire to metal plates such as chassis frames. The techniques and equipment used in the welding operation are described. R.B.

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N70-26512 Polytechnic Inst. of Brooklyn, N.Y.
QUENCHING IN ARGON ION LASERS

Eugene David Skurnick (Ph.D. Thesis) 1969 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-20369

The object of this thesis is to investigate the high current density laser quenching phenomenon and the concurrent appearance of ringmodes. Radiation trapping of the lower laser level as a quenching mechanism is analyzed. It is shown that collisional de-excitation masks the trapping effect and is itself responsible for quenching. A comparison of the collisional de-excitation theory and available experimental results shows good agreement. The quenching phenomenon is further analyzed as a spatially inhomogeneous gain profile, which when included in the resonator equation, predicts the appearance of the ring modes. The theory and design of a ring discharge type ion laser, which shows promise of very high current density operation, is also reported. Dissert. Abstr.

N70-26640# Edgerton, Germeshausen and Grier, Inc., Goleta, Calif.
HIGH-POWER LASER CARRIER INVESTIGATIONS Technical Report

J. C. Clark Jun. 1969 19 p refs Prepared for Calif. Univ.
(Contract AT(29-1)-1183)
(EGG-1183-2216; TR-S-461-R) Avail: CFSTI

Techniques for providing a smooth output pulse from a ruby laser by use of an intracavity nonlinear absorber as a control element were investigated. The nonlinear absorber consisted of a scattering cell filled with an anisotropic molecular liquid in which the onset of stimulated Rayleigh emission provided an abrupt nonlinearity. A pulse of several microseconds' duration and multikilowatt peak power output with minimum noise due to random fluctuations of intensity was desired. With only the scattering cell added to the ruby laser cavity the output pulses obtained were several hundred microseconds long with a peak amplitude of a few hundred watts. However, there was still residual spiking in the output to the extent of 20% of the peak amplitude. Use of the scattering cell in a Q-switched ruby laser provided 30-to-50 microsec pulses of 15 kilowatts peak power. These pulses were not reliably obtained, however, and their character was very sensitive to pump power and adjustment of cavity elements. Further experimental study is required to determine optimum parameters for obtaining the desired pulses. Author (NSA)

N70-26789# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF HEATING ON THE OPERATION OF A RUBY LASER

A. S. Rubanaw et al. 17 Oct. 1969 12 p refs Transl. into ENGLISH from Ser. Fiz.-Mat. Navuk (USSR), no. 2, 1968 p 80-85
(AD-700592; FTD-HT-23-523-69) Avail: CFSTI CSCL 20/5

The article attempts to determine the detrimental effects of heating on the efficient operation of a ruby laser. It examines the problems of laser cooling, both air and water, used to increase the operating efficiency of lasers. Author (TAB)

N70-26807*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LASER DOPPLER SYSTEM FOR MEASURING THREE-DIMENSIONAL VECTOR VELOCITY Patent Application

Robert M. Huffaker, Kenneth F. Kinnard, and Edward Rolfe, inventors (to NASA) Filed 22 Apr. 1969 12 p
(NASA-Case-MFS-20386; US-Patent-Appl-SN-818349) Avail: CFSTI CSCL 20E

A laser Doppler velocimeter for measuring the mean velocity and turbulence of a fluid flow is described. Optical homodyning of a portion of a laser beam scattered from moving particles embedded in a flowing fluid with a portion of the laser beam is made from three different viewing angles to produce beat signals at the frequency of the Doppler shift due to the motion of the fluid. The Doppler shift signal containing the mean velocity and turbulence information is frequency demodulated to produce a fluctuating dc output. The dc output corresponds to a carrier frequency or mean velocity of the fluid and a time-dependent random signal corresponding to the turbulent fluctuations in the fluid flow. NASA

N70-26812# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TEMPERATURE DEPENDENCE OF THE FREQUENCY OF RUBY LASER EMISSION WITH A PHTHALOCYANIN SHUTTER
V. A. Ivanov et al 18 Sep. 1969 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR (Minsk), v. 11, no. 7, 1967 p 590–592
(AD-700625; FTD-HT-23-475-69) Avail: CFSTI CSCL 20/5

A Q-spoiled ruby laser (120 x 12 mm ruby), pumped by an IFP-2000 lamp with a phthalocyanin shutter was used to determine the temperature dependence of laser emission. Interferograms were taken at 3 degrees temperature intervals with a Fabry-Perot interferometer. The results showed a shift in generation frequency toward large wavelengths with an increase in ruby temperature. The average value of the shift was 0.1 /cm(-1) per degree in the 14-30 degree centigrade region of ruby temperature change. TAB

N70-26899# Westinghouse Research Labs., Pittsburgh, Pa.
OPTICAL PUMPING OF LASERS Annual Technical Report, 1 Jul.–31 Dec. 1969
Lyle H. Taylor, Irving Liberman, Richard Liebermann, Alex Federowicz, and Lloyd Armstrong, Jr. 30 Jan. 1970 116 p refs
(Contract N00014-69-C-0428; ARPA Order 1312)
(AD-700949; Rept-70-9C1-SOOPL-R1; ATR-2) Avail: CFSTI CSCL 20/5

The emission spectra of 40 amp-2.5 atm xenon and krypton arc discharges are calculated. The spectral overlap of these spectra and the measured emission spectra of tungsten and potassium-mercury arc discharges with the measured absorption spectra of Nd:YAG are calculated. Relative system efficiencies are calculated and agree very well with measured values. It is found that the K-Hg lamp is four times more efficient in pumping Nd:YAG than the studied W, Kr and Xe lamps. Five trial power series expansions and a numerical iterative technique have been selected for the parameter-fitting method of determining electronic radial wave functions of heavy atoms. Author (TAB)

N70-26996# Sandia Corp., Albuquerque, N. Mex. Exploratory Systems Div.
CARBON-LUCITE ABSORBER SYSTEMS FOR LASER MATERIAL STUDIES
N. Curtis Anderholm and Philip D. Anderson Dec. 1969 16 p refs
(SC-DR-69-709) Avail: CFSTI

A method of fabricating an absorber of laser radiation is outlined. Carbon is dispersed in a Lucite matrix, and measurements of some of its properties are reported. From analysis of stress waves generated in the material, limits on the value of the Gruneisen parameter of carbon are discussed. Author

N70-27014# Weather Bureau, Sterling, Va.
EVALUATION OF A LASER FOR USE AS A TRANSMISSOMETER CALIBRATOR Final Report
David H. George and Robert J. McCann Jan. 1970 95 p refs
(FAA Order FA-65-WAI-96)
(FAA-RD-70-1) Avail: CFSTI

A laser transmissometer was evaluated for use in providing an objective method of calibrating the NBS-type transmissometer to the light transmission characteristics of the atmosphere in all weather and visibility conditions. The laser transmissometer was tested by using it to calibrate an NBS-type transmissometer. Visibility measurements from the laser (objective) calibrated NBS-type system were compared with measurements from an identical system calibrated by the normal (subjective) method. Results indicate that the laser method tends to calibrate the NBS-type transmissometer to yield higher runway visual range values than does the normal method of calibration. Deficiencies in the laser system made rigorous testing of the laser device impracticable. An appendix details performance specifications for an improved laser calibrator system. Author

N70-27078# Stanford Research Inst., Menlo Park, Calif.
DEVELOPMENT OF A TURBIDITY-MEASURING UNDERWATER OPTICAL RADAR SYSTEM Final Report, 1 Jun. 1968–31 Aug. 1969
Damala S. Krishnaw, William E. Evans, Richard C. Honey, and Glenn P. Sorenson Dec. 1969 71 p refs
(Contract N00014-68-C-0450)
(AD-701416) Avail: CFSTI CSCL 8/10

The results of a feasibility study of measuring subsurface turbidity in the ocean are presented. The design and development of the laser transmitter and receiver packages of an underwater optical radar system are discussed. The initial performance of the equipment in three field trials in the Pacific Ocean is described, the data obtained is discussed, and the system is evaluated. Author (TAB)

N70-27111*# Stanford Univ., Calif. Microwave Lab.
INVESTIGATION OF LASER DYNAMICS, MODULATION AND CONTROL BY MEANS OF INTRA-CAVITY TIME VARYING PERTURBATION Quarterly Status Report, 1 Feb.–30 Apr. 1970
S. E. Harris Apr. 1970 18 p refs
(Grant NGL-05-020-103)
(NASA-CR-109723; ML-1849; QSR-10) Avail: CFSTI CSCL 20E

Work done in the areas of pulse lengthening via overcoupled internal second harmonic generation, electronic tuning and short pulsing of dyes lasers, laser stabilization, and backward wave oscillation is reported. J.M.C.

N70-27299*# Scientific Translation Service, Santa Barbara, Calif.
INTERFEROMETRY WITH PATH DIFFERENCE UP TO 500 METERS THROUGH A TURBULENT ATMOSPHERE [INTERFEROMETRIYA S RAZNOST'YU KHODA DO 500 M CHEREZ TURBULENTNUYU ATMOSFERY]
V. V. Pokasov et al Washington NASA May 1970 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (USSR), no. 8, 1969 p 139–141
(Contract NASw-2035)
(NASA-TT-F-12900) Avail: CFSTI CSCL 20E

Interference experiments were conducted in the atmosphere for long path differences with simultaneous recording of the laser radiation spectral composition. Experimental values are found to agree with calculated values. Author

N70-27393# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
NONLINEAR INTERACTIONS OF LASER RADIATION Final Report, Aug. 1965–Aug. 1969

J. A. Carruthers and R. J. Collins 1969 19 p refs
(Contract DA-31-1-ARO(D)-402; ARPA Order 675; Proj. Defender)
(AD-701117; AROD-6038-5-O) Avail: CFSTI CSCL 20/5

The work is described briefly under four headings. (1) Optical bridge. (2) Temperature dependence of laser induced breakdown of gases. (3) Pulse crossing points in a self-pulsing He-Ne ring laser, and (4) Pulse velocity and mode pulling in a laser with equally spaced modes. Author (TAB)

N70-27531# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
AXIAL MAGNETIC FIELD EFFECTS ON A SATURATED He-Ne LASER AMPLIFIER
Robert T. Menzies, Andrew Dienes, and Nicholas George Jun. 1969 31 p refs
(Grant AF-AFOSR-68-1492)
(AD-701105; AFOSR-70-0377TR) Avail: CFSTI CSCL 20/5

The behavior of a He-Ne laser amplifier in the presence of an axial magnetic field has been studied experimentally by measuring Faraday rotation and gain for various values of input signal intensity. Two high gain transitions in the 3.39 micrometer region were used for study: a J = 1 to J = 2 transition and a J = 1 to J = 1 transition. Theoretical expressions have been developed which include the nonlinear effects of saturation strength signals. Experimental results clearly show saturation of Faraday rotation; in addition, for the J = 1 to J = 1 transition, a Faraday rotation reversal and a traveling wave magnetic field dip are seen. These results match the theoretical predictions and provide a method for measuring the upper (3s2) level quadrupole moment decay rate. Author (TAB)

N70-27664# Idaho Nuclear Corp., Idaho Falls.
BIBLIOGRAPHY OF LASER PUBLICATIONS OF INTEREST TO EMISSION SPECTROSCOPISTS, 4
Jon M. Baldwin, ed. Jan. 1970 15 p refs
(Contract AT(10-1)-1230)
(IN-1360) Avail: CFSTI

A bibliographic list of laser publications concerning emission spectroscopy included topics on laser beam interactions with gases and condensed phases, as well as, applications of lasers to analysis. S.S.

N70-27717# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
PARAMETRIC DESIGN STUDY OF A LASER DOPPLER ANEMOMETER TO MEASURE TURBULENCE IN 150 TO 1000 M/SEC FLOWS. PART 1: ISOTROPIC TURBULENCE
R. E. W. Jansson 1969 51 p refs
(AASU-289) Avail: CFSTI

A parametric study has been carried out of a laser-Doppler anemometer to measure isotropic turbulence in two-dimensional 150 to 1,000 m/sec flows with fractional turbulence of up to 20%. It is shown that both the conventionally employed geometries (rear-normal and grazing incidence of the beam) lead to instrumental difficulties. However by yawing the beam in the two-dimensional plane a satisfactory compromise can be achieved between conflicting operational constraints. In particular, a degree of control over the laser-Doppler ambiguity, which broadens the received band, can be achieved. The effect of geometry upon spatial resolution is discussed, and it is shown that a resolution of order 0.1 × 0.7 mm is possible without endangering the operational compromise. Signal strength and the fidelity of markers in following turbulent fluctuations is also briefly discussed. Author (ESRO)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N70-26518# Virginia Polytechnic Inst., Blacksburg. Dept. of Metals and Ceramic Engineering.
THE RELATIONSHIP OF NITROGEN CONTENT OF AUSTENITIC STAINLESS STEELS TO STRESS CORROSION Quarterly Report
Gary S. Clevinger Apr. 1969 20 p refs Sponsored in part by US-Euratom Joint Res. and Develop. Program
(Contract AT(40-1)-3208)
(EURAEC-2099; QR-438-19) Avail: CFSTI

Efforts to determine the effects of nitrogen content on stress corrosion of stainless steels are described. Results of work on the effects of aging temperature on corrosion susceptibility of Type 304 stainless steel are reported along with efforts devoted to preparation of specimens for electron microscopy. NSA

N70-26604*# Stanford Research Inst., Menlo Park, Calif.
THE RELATIONSHIP OF OXIDE SCALE DISPLACEMENT REACTIONS TO THE OXIDATION BEHAVIOR OF IN-100
D. L. Douglass May 1969 36 p refs
(Contract NAS3-11165; SRI Proj. PMD-7359)
(NASA-CR-72678) Avail: NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Md. 20740 CSCL 11F

Attempts to induce oxide displacement reactions by inert annealing of preoxidized samples were unsuccessful due to the formation of Al2O3 and NiTiO3. These compounds formed in lieu of NiO which existed to only a minor extent. Subsequent oxidation of pretreated samples at either 1000 or 1100 C showed a gross difference in oxide morphology. Internal oxidation and deep penetration of the oxide into the alloy occurred at 1000 C, whereas no internal oxidation occurred at 1100 C. Improvement of oxidation resistance is discussed in terms of high-temperature prefilming at 1100 C instead of by the originally proposed displacement reactions. Author

N70-26633# Scientific Translation Service, Ann Arbor, Mich.
STUDY OF TERNARY ALLOYS OF URANIUM-MOLYBDENUM-NIOBIUM AND URANIUM-MOLYBDENUM-ZIRCONIUM WITH A LOW-ALLOYING CONTENT
C. Fizzotti and A. Masperoni 1968 52 p Transl. into ENGLISH from Italian Rept. Prepared in cooperation with Oak Ridge Natl. Lab.
(ORNL-TR-2252) Avail: CFSTI

In order to improve the irradiation resistance of metallic uranium, ternary alloys containing Mo + Nb and Zr + Mo were investigated. The structures obtained in these alloys by different heat treatments were characterized by long-term annealing, thermal cycling, and mechanical tests. Isothermal sections of the ternary system U–Mo–Nb are also shown. A few of these heat-treated alloys were selected for irradiation tests. Author (NSA)

N70-26643# Virginia Polytechnic Inst., Blacksburg. Dept. of Metals and Ceramic Engineering.
THE RELATIONSHIP OF NITROGEN CONTENT OF AUSTENITIC STAINLESS STEELS TO STRESS CORROSION Quarterly Report

Gary S. Clevinger Jan. 1969 42 p refs Sponsored in part by US-Euratom Joint Research and Develop. Program
(Contract AT(40-1)-3208)
(EURAEC-2082) Avail: CFSTI

Research directed toward determination of the relations of N content in austenitic stainless steels with their susceptibility to stress corrosion is reported. Results of experiments on low temperature diffusion of interstitials in Type 304 stainless steel are presented along with those on aging of this steel at 200 C. NSA

N70-26659# Brookhaven National Lab., Upton N.Y.
THE CORROSION AND MASS TRANSFER OF PURE IRON, NICKEL, CHROMIUM, AND COBALT IN 660 TO 760 C SODIUM
A. H. Fleitman and H. S. Isaacs [1969] 11 p refs
(BNL-14230) Avail: CFSTI

Specimens of high purity Fe, Cr, Ni, and Co were exposed to Na at 660 to 760 C in a 316 stainless steel loop. Results of the tests show that all the Ni, Fe and Co specimens are etched, i.e., the grain boundaries are attacked. The Cr specimens are similarly affected except for those in the 112 ppM oxygen Na. These latter specimens have a dark grey film. Ni specimens lose weight while Fe and Co specimens gain weight. The larger weight changes occur at the higher temperatures. Cr. specimens undergo little or no weight changes. Mass transfer of Fe, Ni, Cr and Co occurs. As the oxygen concentration in Na is increased from 4 to 110 ppM, deposition of Fe increases sharply, deposition of Ni is unchanged and deposition of Cr is increased slightly. Only traces of Co deposition were found. NSA

N70-26666# Argonne National Lab., Ill.
PRELIMINARY ANALYSIS OF DEFECTS IN METALS
D. L. Waidelich Jul. 1969 35 p refs
(Contract W-31-109-eng-38)
(ANL-7587) Avail: CFSTI

Preliminary analyses leading toward the determination of the response of defects to the pulsed eddy currents used in nondestructive testing are described. The response of a pulsed vertical magnetic field in air above the surface of an infinitely thick metal is the voltage in a pickup coil. A similar analysis for metals having finite thickness is also discussed. A short survey of references involving information about defects is also presented. Author (NSA)

N70-26671# Los Alamos Scientific Lab., N.Mex.
INFLUENCE OF SMALL ADDITIONS OF ALLOYING ELEMENTS
Michel Colombie et al [1969] 24 p refs Transl. into ENGLISH from Rept. CEA-R-3529 Sponsored by AEC
(LA-tr-69-25; CEA-R-3529) Avail: CFSTI

The advantages of refining the primary gamma crystallization in uranium and its alloys are presented. The refining or the control of the gamma grains can be obtained either by modifying the solidification kinetics, or by the addition of very small amounts of alloying elements. The second method is considered and particular attention paid to the refining role played by elements of low atomic number. The presence of carbon in concentrations of less than 1000 × 10 to the minus 6th power in U–Mo alloys leads to a definite refining effect on the primary gamma crystallization. For a given rate of solidification, this effect is a maximum for a carbon content of between 500 and 800 × 10 to the minus 6th power. The importance of this maximum decreases with the cooling rate; it is very marked for fast rates and disappears in the case of low cooling rates. The addition of carbon gives rise to the formation of uranium carbides whose nature and dispersion state depend on the solidification kinetics. Author (NSA)

N70-26710# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
MEASUREMENTS OF THE THERMAL CONDUCTIVITY AND ELECTRICAL RESISTIVITY OF HIGH-ALLOY FERRITIC STEELS [MERITVE TOPLOTNE PREVODNOSTI IN ELEKTRICNE UPORNOSTI VISOKOLEGIRANIH FERITNIH JEKEL]
T. Perme, Dj. Krstic, and F. Vodopivec Jun. 1969 31 p refs In SERBO-CROATIAN; ENGLISH summary
(NIJS-P-245) Avail: AEC Depository Libraries

In work with materials for the fast breeder reactors, five high-alloy ferritic steels were chosen. The specimens were analyzed metallographically before and after the measurements. The thermal conductivities of these five specimens were measured by the radial heat flow method in the interval 70 C to 800 C. The accuracy of the measurements was + or – 8%. The electrical resistivities were measured by the UI method with + or – 2% accuracy from the room temperature to 800 C. The equipment, methods of measuring, and analysis of the accuracy of the measurements are described in detail. The measured temperature dependences are characteristic for high-alloy steels and increase with increasing temperature. At 800 C the thermal conductivities of five steels are between 0.24 to 0.27 W/cm C. The electrical resistivities at 800 C are between 108 to 113 micro-ohms cm. Author (NSA)

N70-26762# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CORROSION OF CARBON STEEL IN ACETIC ACID AND AN ELECTROCHEMICAL METHOD FOR PROTECTING THE STEEL
A. A. Farkhadov et al 11 Sep. 1969 12 p Transl. into ENGLISH from Borba s Korroziei v Khim. i Neftaperarab. Prom. (USSR), no. 1, 1967 p 86–91
(AD-700385; FTD-HT-23-427-69) Avail: CFSTI CSCL 13/8

Carbon steel with cathode protection can be used in place of stainless steel in a medium of acetic acid. In this way cathode protection can be realized for tanks used in storing acetic acid and in the production of cellulose acetate and cellulose triacetate. Author (TAB)

N70-26764# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHASE DIAGRAM OF THE NIOBIUM-TIN SYSTEM
V. N. Svechnikov et al 7 Oct. 1969 15 p refs Transl. into ENGLISH from the Proc. of 2nd/3rd Soveshch. po Metalloved. Fiz.-Khim. i Metallofizike Sverkhprovodnikov (USSR), 1966 p 152–157
(AD-700589; FTD-MT-24-178-69) Avail: CFSTI CSCL 11/6

The phase diagram of the high tin portion of the niobium-tin system was constructed. The temperature range of stability of the various intermetallic compounds was determined. Ten alloys were arc melted, cast, and annealed at 750 degrees centigrade for 700 hr. On the basis of x-ray, thermal and microstructural analysis, a phase diagram was constructed. Differential thermal curves are given, and the various temperature peaks are analyzed. Besides Nb3Sn, two other intermetallic compounds, Nb6Sn5 and NbSn2 exist in the niobium-tin system. However, they only form upon protracted annealing. For case niobium-tin alloys, in which the compounds Nb6 and NbSn2 are absent but in which the above monotectic occurs, a metastable equilibrium diagram can be constructed. In the metastable diagram, the equilibrium monotectic temperature and composition may differ from that obtained for a stable diagram. Apparently, the niobium-tin diagram obtained by Agafonov, et al is a metastable one. Author (TAB)

N70-26917# Battelle Memorial Inst., Columbus, Ohio.
MECHANICAL-PROPERTY DATA 7178 ALUMINUM, T76 SHEET

1969 9 p refs
(Contract F33615-69-C-1115)
(AD-701116) Avail: CFSTI CSCL 11/6

The -T76 temper for 7178 was developed as compromise between the exfoliation resistance of 7075-T73 and the structural capability of 7075-T6. It was to achieve an increase in resistance to exfoliation over that of 7075-T6 while maintaining a high level of strength and fracture toughness characteristics. TAB

N70-26935# British Steel Corp., London (England). Northern and Tubes Group.

THE DETERMINATION OF VANADIUM IN STEEL

J. Davey 1970 4 p refs
(PB-188758; NT/EC.69/5) Avail: CFSTI CSCL 11F

The British Standard method for the determination of vanadium in steel can give inaccurate results when determining vanadium contents below about 0.05%. An investigation was made into methods of determining vanadium and a method using N-cinnamoyl-N-phenylhydroxylamine after the separation of iron in a miniature mercury cathode cell is described. This procedure gives accurate results in the presence of all residual elements in carbon manganese steels at levels higher than normally encountered. Author(USGRDR)

N70-26936# Georgia Inst. of Tech., Atlanta. School of Chemical Engineering.

A STUDY OF THE STRUCTURE AND MECHANICAL PROPERTIES OF ORDERED ALLOYS Technical Progress Report, 1 Apr. -31 Dec. 1968

B. G. LeFevre and E. A. Starke, Jr. Dec. 1969 47 p refs
(Contract AT(40-1)-3908)
(ORO-3908-1) Avail: CFSTI

The microstructure of Ni3Si and that of Ni4Mo were studied for correlation with the mechanical properties of these ordered materials. Initial studies of Ni3Si indicated that this phase was difficult to obtain without contamination by Ni3Si2 which embrittled the samples. Consequently, studies of Ni-Si alloys were terminated. The ordering of Ni4Mo during isothermal aging at 700 C was found to proceed homogeneously until late in the process when a heterogeneous reaction was initiated along the grain boundaries. The large increase in strength during ordering of this alloy is attributed to the domain size and the stresses induced due to the tetragonality of the ordered phase. The decrease in ductility during ordering is a result of either the development of dislocations in coplanar arrays or concentrated slip in the heterogeneous component. Author (NSA)

N70-26937# California Univ., Livermore. Lawrence Radiation Lab.

NON-DESTRUCTIVE CHARACTERIZATION OF HYDROGEN-EMBRITTLEMENT CRACKING BY ACOUSTIC EMISSION TECHNIQUES

H. L. Dunegan and A. S. Tetelman 10 Nov. 1969 39 p refs Presented at ASM Mat. Eng. Congr. and Exposition, Philadelphia, 13-16 Oct. 1969
(UCRL-71654; CONF-691023-1) Avail: CFSTI

Acoustic emission techniques were used to determine the rate of cracking of high-strength steel due to hydrogen embrittlement, making it possible to predict failure in certain structural components undergoing hydrogen attack. The acoustic emission rate from a hydrogen-charged, linear-compliance, fracture-toughness specimen of high-strength 4340 steel was recorded as a function of the stress-intensity factor at the crack tip in the specimen. The structural component (a hydrogen-charged bolt of the same material) was then torqued down in a simple fixture and the acoustic emission was recorded as a function of time. The acoustic emission rate obtained from a near-critical value of the stress-intensity factor of the fracture-toughness specimen was used to predict within + or - 15 percent the time for the onset of unstable failure of the bolt. The most significant result of this investigation is that regardless of the initial loading, nucleation time for cracking to begin, or any other factors connected with geometrical differences in specimens, the acoustic emission rate can be used to determine the time for the stress intensity factor at the onset of rapid fracture. Author (NSA)

N70-26986# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SHORT-DURATION AND STRESS-RUPTURE STRENGTH OF BETA-ALLOY OF Ti-Mo-Cr-Fe-Al SYSTEM AT HIGH TEMPERATURES

N. V. Ageev et al 16 Oct. 1969 16 p refs Transl. into ENGLISH from Tr. Akad. Nauk SSSR Inst. Met. (Moscow), 1967 p 294-300
(AD-700391; FTD-MT-24-240-69) Avail: CFSTI CSCL 11/6

A beta-alloy of Ti contg. Mo 7, Cr 5.5, Fe 3, and Al 3 percent when quenched from 800 degrees and aged at 550 or 525 degrees for 15 hrs. at 500 degrees for 20 hrs., and at 450 degrees for 50 hrs. exhibits high mech. properties at elevated temps. When exposed to the anticipated working temp. (350 degrees) for 100, 500, and 1000 hrs. its mech. properties are influenced slightly, indicating high thermal stability. To accomplish the heat-resistance tests, specimens 4 mm. in diam. were subjected to bending with the application of centrifugal force that permitted a simultaneous detn. of creep resistance and stress-rupture strength. The samples were tested at 350 degrees in the air and the rate of creep was assessed from bending inflection. The microstructure of strained samples after 250 hrs. testing differs slightly from that of initial specimens and the only change observable is the appearance of subgrain boundaries in primary beta-grains. Specimens quenched from 800 degrees and aged according to the regime A or B were tested as to heat resistance at 20-700 degrees. From 250 to 450 degrees their mech. strength varies slightly. At 500 degrees it decreases but still maintains relatively high values, 92 and 105 kg/(sq-mm) for alloys aged at 525 and 550 degrees resp. Author (TAB)

N70-26988 National Lending Library for Science and Technology, Boston Spa (England).

THE COAGULATION KINETICS OF FINELY DISPERSED PHASES IN METALLIC ALLOYS [O KINETIKA KOAGULATSII MELKODISPERSNYKH FAZ V METALLICHESKIKH SPLAVAKH]

V. I. Psarev et al Feb. 1970 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 9, 1966 p 16-20
(NLL-RTS-5561) Avail: Natl. Lending Library, Boston Spa, Engl.: 12s 6d or 2 NLL photocopy coupons

The coagulation formulas underlying the relationships between the average radius and number of dispersed particles in alloys during isothermal soaking are derived by direct theoretical calculation and the underlying molecular kinetics model of the coagulation of dispersed phases in metallic alloys is discussed. R.B.

N70-26992# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF THE FORMATION OF TITANIUM ALUMINIDE Ti3Al FROM A SOLID SOLUTION BY THE MODULUS OF ELASTICITY METHOD

I. I. Kornilov et al 26 Sep. 1969 12 p refs Transl. into ENGLISH from Diffuz. Protsessy Metal. (USSR), 1968 p 110-113
(AD-700626; FTD-MT-24-218-69) Avail: CFSTI CSCL 11/6

The effect of heat treatment of Ti-Al alloys of constitution near to that of Ti3Al and contg. 15.9 and 16.6 percent Al by wt. on their mech. properties were studied. The modulus of elasticity E and the modulus of transverse elasticity G were detd. by the resonance method. The specimens were annealed at 600 degrees for 200 hrs., then were heated in sealed quartz ampuls at 800, 900, 1000, 1100, 1150, 1200, and 1300 degrees for 48, 24, 18,

3, 2, 1, and 0.4 hrs., resp., and quenched in water. The results obtained show the continuous decrease of E and G, as the quenching temps. increase in the range of 900-1100 degrees for 15.9 percent and 900-1150 degrees for 16.6 percent Al. Further increasing of these temps. caused increase of E and G. Afterwards the specimen of 15.9 percent Al was quenched from 1100 degrees again and the effect of the duration of its tempering at 600, 700, and 800 degrees on the parameters investigated was studied. G and E increase only during the 1st 5-10 hrs. of tempering at 600-700 degrees. Further holding of alloy at these temps. did not affect these parameters. The tempering at 800 degrees caused increase of G and E only during the 1st 2 hrs. and further holding caused decrease of these parameters down to values for as-quenched state. TAB

N70-26997# Sandia Corp., Albuquerque, N. Mex. Technical Translation Service.

CERTAIN PROPERTIES OF MOLTEN (LIQUID) ALUMINUM OXIDE [NEKOTORYE SVOISTVA ZHIDKOY OKISI ALIUMINIA]

U. V. Zubarev et al 5 Jan. 1970 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Neorg. Mater. (Moscow), v. 5, 1969 p 1563 1565

(SC-T-70-4000) Avail: CFSTI

The measurement of density and of surface tension is performed by the method of the so-called sessile drop. The calculation of the surface tension, as well as of the density, was carried out. The temperature was measured on the basis of the blackening of the photographic plate. The experimental results were listed. Author

N70-27007# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MICROHETEROGENEITY OF SINGLE-PHASE ALPHA-ALLOYS OF TITANIUM ACCORDING TO EQUILIBRIUM PHASE DIAGRAMS

O. S. Belova et al 2 Oct. 1969 16 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Tsvet. Met. (USSR), v. 11, no. 5, 1968 p 83–88

(AD-700395; FTD-MT-24-222-69) Avail: CFSTI CSCL 11/6

By method of complex phase shift analysis it is shown that single-phase alpha-alloys of titanium, according to equilibrium phase diagrams, are not uniform. Microheterogeneity revealed in them is not reflected by phase diagram and is represented by segregates with lattice of alpha-titanium, formed as a result of accelerated diffusion in places with crystal lattice defects. Author (TAB)

N70-27009# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CHANGES IN THE STRUCTURE OF GRAY AND WHITE CAST IRON IN A REGION AFFECTED BY LASER EMISSION

Yu. I. Davydov et al 10 Sep. 1969 13 p refs Transl. into ENGLISH from Fiz. i Khim. Obrab. Materialov (USSR), no. 1, 1969 p 17–22

(AD-700796; FTD-HT-23-478-69) Avail: CFSTI CSCL 11/6

During the action of a laser pulse on gray cast iron the following specific effects appear: the liquid phase on the metal surface shrinks into individual drops; the front of the melted zone makes wedgelike penetrations into the depth of the metal along the graphite lamella; gas is liberated from the graphite lamella, forming cavities in the melted zone. When a laser pulse acts on white cast iron a specific affect is observed, consisting of precipitation of a disperse ferrous phase in the cementite; as a result the microhardness of the cementite and its etchability by reagents are increased. The perlite structural component in gray and white cast iron undergoes basically the same transformations as arise under the action of a laser on carbon steel. Author (TAB)

N70-27015# Naval Research Lab., Washington, D.C. Metallurgy Div.

CHARPY-V NOTCH DUCTILITY CHARACTERISTICS OF NEUTRON-IRRADIATED A537-B AND A350-LF2 STEEL WELDMENTS

Robert A. Gray, Sr. 16 Jan. 1970 17 p refs

(Contract AT(49-5)-2110)

(AD-701322; NRL-7006) Avail: CFSTI CSCL 18/10

The nuclear service performance of thin (3/4-inch) structural steel plate irradiated at 150F (65C) to a fluence of 2.5 x 10 to the 18th power neutrons sq cm of energies greater than 1 MeV has been examined and documented with experimental results. Five 3/4-inch A537-B steel plates, an A350-LF2 forging, and weldments of both types of steel provided the specimen stock for the irradiation assessments. The two steels responded to low-temperature irradiation in a manner similar to a well-documented A212-B pressure vessel steel. However, both A537-B and A350-LF2 steels have an inherently greater tolerance to the effects of irradiation damage by virtue of their lower initial transition temperature. Embrittlement due to irradiation produced increases in transition temperature, but for no component of the weldments studied was the 30-ft-lb value greater than 65F (18C). The postirradiation assessments of the Charpy-V notch shelf energy values of A537-B plate in the ASTM WR orientation (weak direction) revealed a marked reduction in the steels fracture resistance at maximum (shelf-level) ductility. This is believed to be due to the high cross-rolling ratio and points up the need to maintain ratios near unity to insure WR notch ductility properties approximating those for the RW (strong) direction. Author (TAB)

N70-27030*# McDonnell-Douglas Co., Huntington Beach, Calif. Materials and Methods Research and Development Dept.

THE EFFECTS OF A HYDROGEN ENVIRONMENT ON THE MECHANICAL PROPERTIES OF FORGED Ti-6Al-4V ELI WELDMENTS Final Report, 27 Jun. - 1 Nov. 1969

G. F. Pittinato Nov. 1969 109 p refs *Its* Catalog No. PDL-92706-5

(Contract NAS8-21470)

(NASA-CR-102660; DAC-62146) Avail: CFSTI CSCL 11F

The effects of hydrogen on forged (STA) Ti-6Al-4V ELI material containing a fillerless weld are shown. Tensile data showed that there was no gross change in the tensile properties of oxide free samples of Ti-6Al-4V ELI as a result of testing in hydrogen gas. There was, however, a slight decrease (approximately 1 to 3%) in the tensile properties for those samples tested in hydrogen environments regardless of the additional testing parameters. A hydrogen environment was found to increase the fatigue crack growth rate in Ti-6Al-4V ELI (STA) and weld material in the temperature range of ambient to 100 F. At 200 F, there was no significant difference between the crack growth rates obtained in helium and hydrogen gas. The degree of hydrogen enhanced crack growth was found to be dependent on the stress intensity range, temperature, and microstructure of the material. The hydrogen enhanced crack growth was explained by using a model involving hydrogen diffusion. Author

N70-27044# Sandia Corp., Albuquerque, N. Mex. Technical Translation Service.

INFLUENCE OF CARBON ON THE CURIE TEMPERATURE AND THE SPONTANEOUS MAGNETIZATION IN NiFe ALLOYS WITH 20% TO 50% NI [EINFLUSS VON KOHLENSTOFF AUF CURIE-TEMPERATUR UND SPONTANE MAGNETISIERUNG BEI NiFe- LEGIERUNGEN MIT 20 BIS 50% Ni]

E. Adler et al 22 Jan. 1970 22 p refs Transl. into ENGLISH from Z. Angew. Phys. (W. Berlin), v. 26, 1969 p 105 113

(SC-T-70-4004) Avail: CFSTI

Solute carbon in f.c.c. Ni-Fe alloys with 20% to 40% nickel causes a strong increase of Curie point and spontaneous

magnetization. This initially surprising effect is due to the lattice expansion by interstitially dissolved carbon; it counteracts the normal decrease of Curie temperature and spontaneous magnetization caused by electron interaction. The experimental results are compatible with the existence of a latent antiferromagnetism theory. Based on these considerations, two smaller effects may also be explained which, upon heating of the samples, are caused by reorientation of carbon- and lattice-atoms respectively. The investigations, moreover, make it possible to interpret the anomalous course of induced magnetic carbon anisotropy found earlier in these alloys. Author

N70-27065# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

USE OF COORDINATE NET IN THE INVESTIGATION OF THE PROCESS OF EXTRUSION OF TITANIUM ALLOYS WHICH EXHIBIT ANISOTROPY

Yu. M. Aryshenskii et al 25 Nov. 1969 13 p refs Transl. into ENGLISH from the Russian

(AD-701236; FTD-HT-23-400-69) Avail: CFSTI CSCL 20/12

In order to determine the strains and the stresses which arise in one of the sides of leaf specimens, there was applied, by the photocontact method, a net consisting of intersecting circles of diameter 10 mm. The scale of the net was applied on a leaf of transparent plastic and was measured with a travelling microscope with precision of 1 micron. During the course of the experiment, the circles were transformed into ellipses, the size of the axes of which allowed the strain to be determined. Since alloys VT1-2 and OT4-1 exhibit transversal isotropy, an attempt was made to obtain the equations of the connection between the strains and stresses on the basis of the generalized Hooke law. The equations obtained were subjected to experimental confirmation by means of the extension of specimens in which the working length was equal to the breadth. Author (TAB)

N70-27114*# Martin Marietta Corp., Denver, Colo.

PROPERTIES OF CRYOGENICALLY WORKED MATERIALS Interim Report

R. D. Masteller, H. J. Brown, R. G. Herzog, and S. H. Osgood 1 May 1970 238 p refs

(Contract NAS3-12028)

(NASA-CR-72638) Avail: CFSTI CSCL 11F

Fifteen metallic alloys were tested to determine whether straining (uniaxial tension) at cryogenic temperatures developed higher strengths than did straining at room temperature. Two alloys were significantly strengthened by cryostraining: PH 14-8 Mo, a precipitation hardening stainless steel; and MP 35 N, a nickel-cobalt alloy. Seven alloys: 6061, 5456, Inconel 718, Nickel 440, beryllium copper, A-286, and 21-6-9 could be strained greater amounts, thereby developing higher strengths, at cryogenic temperatures than at room temperature. Author

N70-27117*# IIT Research Inst., Chicago, Ill. Technology Center.

PROTECTIVE COATINGS FOR REFRACTORY METALS IN ROCKET ENGINES Final Report, 13 Jan. 1968 13 Mar. 1969

5 Aug. 1969 148 p refs

(Contract NAS7-431; IITRI Proj. B6058)

(NASA-CR-109725; IITRI-B6058-40) Avail: CFSTI CSCL 11F

Coating systems of refractory metals for use on rocket nozzles for liquid propellants containing both fluorides and oxygen were developed. Tungsten, iridium, Ir-33 w/o Re, rhenium, ATJ graphite, HfC-20 v/o C, TaC-20 v/o C, and ZrB2-SiC-C were evaluated in oxygen, fluorine, hydrogen fluoride, fluorine-oxygen, and hydrogen fluoride-oxygen atmospheres at 3000 5500 F. In all environments iridium and iridium-33Re had the lowest recession rates to their respective melting points of 4450 F and 4750 F; rhenium had the lowest recession rates in the combined environments at 5000 F. Materials which form solid oxides were not resistant to the combined environments. Development of Ir-Re/Re duplex coatings by slurry techniques was investigated. Sintering studies showed that Ir-20Re coatings could be developed using the same technique used for unalloyed iridium. Sintered carbide coatings based on Hf-10Ta for use on Ta-10W substrates were investigated. High density coatings could not be sintered at carbon contents above 4.5 w/o carbon. Author

N70-27144# United States Steel Corp., Pittsburgh, Pa. Education, Training, and College Relations.

STRUCTURAL METALS: STEEL

R. L. Brockenbrough 1969 11 p refs *Its* Sci. and Tech. V. 16, No. 41

Avail: CFSTI

A large number of steels are currently used for structural applications. The characteristics of some of the most widely used steels are briefly described, current design and fabrication trends are reviewed, and future trends of structural steels are discussed. Author

N70-27145# United States Steel Corp., Pittsburgh, Pa. Education, Training, and College Relations.

WHERE WE STAND IN WELDING ULTRAHIGH-STRENGTH STEELS

A. M. Rathbone 1969 7 p refs *Its* Sci. and Tech. V. 16, No. 32

Avail: CFSTI

The mechanical properties of high yield strength steels are reviewed. Two steels are mainly discussed, a 5Ni-Cr-MO-V steel with yield strength of 130,000 to 140,000 psi and a 10Ni-Cr-Mo-Co steel with yield strength of 180,000 to 210,000 psi. The fabricability, weldability, and resistance to stress corrosion cracking are described. N.E.N.

N70-27152# Ohio State Univ. Research Foundation, Columbus. Dept. of Metallurgical Engineering.

A STUDY OF THE MECHANISM OF STRESS CORROSION CRACKING IN THE IRON-NICKEL-CHROMIUM ALLOY SYSTEM Quarterly Report, 17 Mar. 16 Jun. 1969

R. W. Staehle 3 Sep. 1969 58 p refs

(Contract AT(11-1)-1319)

(COO-1319-78) Avail: CFSTI

Included herein are results from stress corrosion testing in a circulating autoclave and boiling $MgCl_2$ environments. For the circulating autoclave data are reported to Cl levels as low as 0.5 ppm at 2050 C. In the boiling $MgCl_2$ experimental data are reported for additions of a new series of alloys (Be, C, and Al) which show very substantial improvements in stress corrosion cracking resistance. Author

N70-27153# Minnesota Univ., Minneapolis. School of Mineral and Metallurgical Engineering.

A STUDY OF GRAIN BOUNDARY SEGREGATION USING THE AUGER ELECTRON EMISSION TECHNIQUE Annual Technical Progress Report

D. F. Stein, A. Joshi, and P. V. Ramasubramanian 29 Dec. 1969 8 p refs

(Contract AT(11-1)-1778)

(COO-1778-3; ATPR-2) Avail: CFSTI

Auger Emission Analysis has shown that a segregation of certain elements to grain boundaries results in embrittlement. In steels which undergo temper embrittlement it has been shown that P, As, Ni, and Cr are segregated to grain boundaries in the embrittled condition, but not in the non-embrittled condition. In W, the amount of phosphorous at the grain boundary is related to the ductile brittle transition. Preliminary work in Mo indicates that P

is primarily responsible for the embrittlement of this material. A brief description of work using Ga to embrittle grain boundaries in Al is given. Preliminary results on O and P embrittlement of pure iron are also given. Author

N70-27168# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
X-RAY STUDY OF THE STRUCTURE OF LIQUID METALS AND ALLOYS Annual Progress Report, 1 Jan. - 31 Dec. 1969
C. N. J. Wagner Dec. 1969 11 p refs
(Contract AT(30-1)-2560)
(YALE-2560-26) Avail: CFSTI

The temperature dependence of the structure of liquid Cd, Zn, and Sn was studied using the recently constructed X-ray transmission diffractometer with high temperature camera (for Zn, Cd, and Sn) and the older reflection or theta-theta diffractometer (for Sn only). Both transmission and reflection techniques yielded good agreement for Sn. A decrease of the height of the first peak maximum in I(K) with increasing temperature was observed in Sn, similar to that previously found in liquid In, Tl, and Pb, but only small changes in Cd and Zn. The interatomic distances evaluated from the radial distribution function remained constant or decreased slightly with increasing temperature. The atomic distributions in liquid Cu-Sn alloys were determined from the X-ray scattering measured on the theta-theta diffractometer at temperatures slightly above the liquidus and at 1100 C. The partial interference functions and their Fourier transforms, the pair distribution functions, were evaluated. Author (NSA)

N70-27172*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A STRESS CORROSION EVALUATION OF AISI - H-11 ALLOY STEEL PLATED WITH NICKEL-CADMIUM COATING
J. W. Montano 2 Apr. 1970 31 p refs
(NASA-TM-X-64510) Avail: CFSTI CSCL 11F

This report presents the mechanical properties of AISI - H-11 alloy steel bar specimens (0.125 inch diameter), C-ring specimens (1.0 inch diameter) and charpy V-notched impact specimens, heat treated to 220 to 240 ksi ultimate tensile strength range and plated with nickel-cadmium. The tensile specimens and C-ring specimens were stressed to longitudinal yield strength respectively, and exposed to: (1) 180 days of exposure to the atmospheric conditions prevalent at the Marshall Space Flight Center during the months of December through June, and (2) 180 days of alternate immersion testing in a 3.5 percent sodium chloride solution. Unplated control specimens were also used in the stressed and unstressed condition for comparison purposes. The ultimate tensile strength of the plated specimens was generally unaffected with exposure time, but in some instances there was a slight decrease in the 0.2 percent yield strength after 180 days exposure. There were no failures in the plated tensile specimens or in the C-ring specimens which were exposed to the MSFC atmosphere. Two failures occurred in the plated C-ring specimens which were subjected to the alternate immersion test. Author

N70-27208# Clarkson Coll. of Technology, Potsdam, N.Y.
TRANSPORT AND MAGNETIC PHENOMENA IN CHROMIUM AND IRON ALLOYS, PART 1 Technical Progress Report, 1 Apr. 1969 - 1 Jan. 1970
Sigurds Arajs 1970 7 p
(NYO-4079-4) Avail: CFSTI

Studies on the electrical resistivity, thermoelectric power, and magnetization of different chromium and iron base alloys are briefly described. About 90% of the total time was spent on various proposed research projects using different apparatuses in operating condition. The remaining time was devoted to building additional facilities so that other phases of the proposed research could be carried out in the future. Author

N70-27210# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
GRAINS: A QUASI-DYNAMIC CODE FOR COMPUTER SIMULATION EXPERIMENTS OF POINT AND LINE DEFECTS IN METAL
R. E. Dahl, J. R. Beeler, Jr., and R. D. Bourquin Jan. 1970 87 p refs
(Contract AT(45-1)-1830)
(BNWL-1248) Avail: CFSTI

The dynamic method of computer experimentation is used with an energy quench mode for accelerated convergence. It has been used in studies of grain boundaries and vacancy and interstitial complexes in iron and nickel. The results obtained for formation, migration and interfacial energies are in close agreement with those from other computer experiments and laboratory measurements. Author

N70-27213# Oak Ridge National Lab., Tenn.
CATASTROPHIC CORROSION OF TYPE 304 STAINLESS STEEL IN A SYSTEM CIRCULATING FUSED SODIUM FLUOROBORATE
J. W. Koger and A. P. Litman Jan. 1970 22 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2741) Avail: CFSTI

A type 304 stainless steel liquid level probe contacted fluoroborate salt (NaBF4-8 mole % NaF) in an Inconel 600 pump loop at constant temperatures in the range 540 to 690 C for 192 hr. The probe exhibited heavy attack, evidenced by severe leaching of Cr, Fe, Mn, and Si from the alloy. Equivalent uniform attack was about 4 mils/day. Corrosion of the stainless steel, which is inferior to nickel-base alloys in fused fluorides, became catastrophic in this system due to dissimilar-metal effects. Author (NSA)

N70-27243# Oak Ridge National Lab., Tenn.
COMPUTER PROGRAM FOR CALCULATING THE CONFIGURATIONAL CHANGES IN NONRANDOM ALLOYS DUE TO DEFORMATION
R. O. Williams Feb. 1970 23 p
(Contract W-7405-eng-26)
(ORNL-TM-2855) Avail: CFSTI

For well-defined deformation the changes in the Warren short-range-order parameters for nonrandom solid solutions are described. A Fortran program is written which sets up the necessary differential equations for the face-centered cubic lattice and obtains a numerical solution in terms of increasing deformation. Author

N70-27308# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
ELECTRICAL RESISTIVITY, THERMOELECTRIC POWER AND X-RAY INTERFERENCE FUNCTION OF AMORPHOUS Ni-Pt-P ALLOYS
Ashok K. Sinha Dec. 1969 17 p refs
(Contract AT(04-3)-221)
(CALT-221-81) Avail: CFSTI

Amorphous alloys containing Ni, Pt, and P were obtained by rapid quenching from the liquid state. X-ray diffraction measurements indicate a high degree of structural disorder in these alloys and an atomic configuration closely similar to that in liquid metals. At room temperature, the electrical resistivity of these alloys lies between 1.9 to 2.5 microvolt/deg K. The thermoelectric power results obtained lead to the conclusion that the average form factor for scattering of electrons decreases with increasing Ni/Pt ratio. Author

N70-27315*# Translation Consultants, Ltd., Arlington, Va.
APPLICATION OF HIGH-TEMPERATURE MATERIALS IN AIRCRAFT JET ENGINES [DIE ANWENDUNG HOCHWARMFESTER WERKSTOFFE IM FLUGTRIEBWERK]

Dieter Hannen et al Washington NASA Apr. 1970 16 p refs Transl. into ENGLISH from DEW (Deut. Edelstahlwerke) Tech. Ber. (Krefeld), v. 9, no. 2, 1969 p 335–343
(Contract NASw-2038)
(NASA-TT-F-12931) Avail: CFSTI CSCL 11F

Special steels, cobalt- and nickel- alloys are discussed which are used in the production of the most recent types of jet engines. The principal properties of these high-temperature steels and alloys are briefly described and it is indicated in which part of the engine for which components, facilitates orientation. For application in compressor production, the standard 12% Cr steels were modified by additions of molybdenum, nickel, columbium-tantalu, and vanadium to improve their high-temperature strength. Cobalt alloys are distinguished by their high scaling resistance, their low susceptibility to thermal shock and their excellent welding properties. Apart from specific alloying techniques, two special measures are taken to make operating with higher gas-inlet temperatures possible and increase the engine efficiency accordingly: (1) surface protection by diffusion of metals into the component surface, and (2) air-cooling which reduces the material temperature of a turbine blade by as much as 250 C. Author

N70-27359*# Translation Consultants, Ltd., Arlington, Va.
APPLICATION OF TEMPERATURE AND HIGH-TEMPERATURE RESISTANT STEELS AND ALLOYS IN STEAM AND GAS TURBINE DESIGN [EINSATZ VON WARMFESTEN UND HOCHWARMFESTEN STAEHLEN UND LEGIERUNGEN IM DAMPF- UND GASTURBINENBAU]
Dieter Hannen et al Washington NASA Apr. 1970 22 p refs Transl. into ENGLISH from DEW (Deut. Edelstahlwerke) Tech., Ber. (Krefeld), v. 9, no. 2, 1969 p 343 352
(Contract NASw-2038)
(NASA-TT-F-12932) Avail: CFSTI CSCL 11F

For steam turbines using steam inlet temperatures of up to 560 C the standard 12% Cr steels were improved by additions of molybdenum and vanadium with the result of better creep rupture properties. For temperatures higher than 600 C high temperature austenitic steels were developed with 16% Cr and 13% Ni or 16% Ni plus molybdenum, tungsten, columbium + tantalum and boron. The low pressure stages will be equipped with increasingly larger blades and will therefore require new corrosion resisting steels with 0.2 limits of over 80 kp/sq mm. In view of the increasing inlet temperatures in gas turbine engines, nickel and cobalt alloys are selected. The materials currently used, their chemical composition and mechanical properties are displayed in tables and diagrams. Author

N70-27389*# Tyco Labs., Inc., Waltham, Mass.
LEAD TELLURIDE BONDING AND SEGMENTATION STUDY Semiannual Phase Report, 1 Aug. 1969 – 31 Jan. 1970
S. Mermelstein, S. Michalik, and F. Wald 31 Jan. 1970 46 p refs
(Contract NAS5-9149)
(NASA-CR-109874; SAR-5) Avail: CFSTI CSCL 11F

Metallurgical investigations centered around the high Co-end of the Co-Ge-Si system in attempts to find a eutectic suitable for brazing MoSi2 to Si-Ge diagram are relatively favorable, success in locating a eutectic with a suitable melting point would immediately make bonding studies feasible. Bonding of the segmented Si-Ge/PbTe couples which are to be used in the submodules is described. Preliminary mechanical and thermal tests on submodule components are described and the module assembly procedures are outlined. Redesign and rework required on the thermoelectric test fixture for submodule testing are described and a literature study of binary systems which might be pertinent for Si-Ge hot shoe brazing is presented. Author

N70-27372# United States Steel Corp., Pittsburgh, Pa.
TENSILE PROPERTIES OF EIGHT STRUCTURAL STEELS BETWEEN 70 AND -320 F
D. P. Clausing 1969 38 p refs *Its* Sci. and Technol., Vol. 16, No. 34
Avail: CFSTI

Tension tests were conducted on eight structural steels having room temperature yield strengths ranging from 39 to 248 ksi. The tensile properties of these eight steels were determined at 70, -100, -200, and -320 F. The results show that the yield strengths and ultimate tensile strengths increased by approximately 60 ksi when the temperature was decreased from 70 to -320 F. Because the absolute increases were roughly the same for all eight steels, the percentage increase was much larger for the low strength steels. For six of the eight steels, the strain hardening was either temperature insensitive or increased when the temperature decreased. The strain at fracture (ductility) was independent of temperature in the range 70 to -200 F. The ductility also showed very little dependence on the yield stress. Author

N70-27392# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France).
PHYSICO-CHEMICAL AND MECHANICAL PROPERTIES OF ALLOYS IN THE MAGNESIUM-YTTRIUM SYSTEM [PROPRIETES PHYSICO-CHIMIQUES ET MECANIQUES DES ALLIAGES DU SYSTEME MAGNESIUM-YTTRIUM]
Dominique Miannay (Ph.D. Thesis—Paris Univ., 16 Jan. 1969) Feb. 1970 163 p refs In FRENCH; ENGLISH summary
(CEA-R-3914) Avail: CFSTI

The equilibrium diagram for the magnesium-yttrium system was determined for yttrium weight concentrations of 0 and 60 per cent. The chemical diffusion parameters in the solid-solution region, and the resistivity of the low-content alloys were also determined. The plastic behavior, both under tension and during creep, of alloys containing small weight percentages were studied. At both high and low temperatures the deformation is activated thermally and the energy and volume of activation were determined. At low temperatures, a softening due to alloying is caused by a change in the obstacles to the dislocation movements as the dissolved atoms and 'forest trees' existing in low-content alloys are replaced by microprecipitates in the alloys with the highest contents. At high temperatures the deformation is governed by the movement of jogged screw dislocations. At intermediate temperature the deformation is athermal and corresponds to the movement of edge dislocations in the overall stress field produced by the dissolved atoms. The apparent activation energies for creep were determined at high temperature. It has been shown that there exist, at moderate temperatures, static and dynamic aging phenomena. Their domains of existence, as far as temperature and rates are concerned, were determined and an explanation to account for their appearance and for their kinetics is proposed. Author (ESRO)

N70-27413# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
ALPHA GRAIN REFINING AND METALLURGICAL STUDY OF ALLOYED URANIUM, SICRAL F, USED FOR FUEL ELEMENTS [AFFINAGE DU GRAIN ALPHA ET ETUDE METALLURGIQUE DE L'ALLIAGE D'URANIUM SICRAL F1 POUR ELEMENTS COMBUSTIBLES]
Pierre Magnier Nov. 1969 92 p refs In FRENCH; ENGLISH summary
(CEA-R-3905)

The aim of this study was to determine the metallurgical factors which aid the refining of low alloyed uranium of composition not very different from SICRAL F1. Alpha grain refining of fuel elements made of these alloys was studied after casting and quenching by the methods used for mass production. The effects of the metallurgical history before quenching including casting, purity, and rate of solidification are described and the quenching parameters

such as annealing temperature before quenching, annealing time, and quenching rate, as well as the composition of the alloy, are considered. For the graphite gas fuel elements of various dimensions, some modifications to give a better adaptation of fabrication to size are suggested. The grain refining made during quenching and the beta yields alpha and gamma yields alpha transformation types are described. The use of a U-Fe-Si alloy, especially suited from the point of view of grain refining, is proposed. Author (ESRO)

N70-27437*# TRW Systems Group, Redondo Beach, Calif.
EVALUATION TESTING OF PROTECTIVE COATINGS ON REFRACTORY METALS Final Report, 29 Aug. 1966 31 Oct. 1969
L. R. Oswalt and R. I. Batista 28 Apr. 1970 357 p
(Contract NAS7-460)
(NASA-CR-109849; TRW-07587-6005-TO-00) Avail: CFSTI CSCL 11F

The determination of the performance capabilities of various refractory metal coating systems operating in a chemical rocket environment are discussed. The general procedure followed in this coating evaluation involved two distinct phases: (1) a series of engine firings to characterize the injector performance and to establish the thermal operating environment in the nozzle throat; and (2) subjection of each test specimen to engine firings of 10 and 1000 seconds or for extended test durations to determine the time and temperature of coating failure, followed by metallurgical evaluations to determine the failure mode and final condition of the coating. As part of the metallurgical evaluations a failure analysis was conducted to correlate the life of the coating with the processing methods and the thermal environment. Author

N70-27469# Argonne National Lab., Ill.
A MODEL FOR VOID FORMATION IN METALS IRRADIATED IN A FAST-NEUTRON ENVIRONMENT
Samuel D. Harkness and Che-Yu Li Aug. 1969 29 p refs
(Contract W-31-109-eng-38)
(ANL-7588) Avail: CFSTI

Experimental observations of void formation in Type 304 stainless steel irradiated with fast neutrons are presented. The irradiated microstructure was characterized by a homogeneous distribution of both polyhedral voids and Frank dislocation loops. Neither defect type, however, formed at grain boundaries. No observable voids formed at 600 C, whereas void formation was greater at 460 C than at 375 C. A model to explain these observations was developed, based on classical nucleation and growth theory. The results from the model were then incorporated into a Johnson-Mehl expression to determine a theoretical temperature dependence for void formation. This approach gave good agreement with experimental results. The presence ofelium atoms is suggested as an important factor in void nucleation in stainless steel. The gas atoms may stabilize the voids, which, in asutenitic stainless steel, are a higher energy form than planar defects. Author (NSA)

N70-27695# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Energiewandlung und Elektrische Antriebe.
CERMETS AS MATERIAL FOR THERMIONIC EMITTERS WITH SPECIAL REGARD TO BARIUM CALCIUM TUNGSTATE/TUNGSTEN ELECTRODES [CERMETS ALS THERMIONISCHE EMITTERWERKSTOFFE VORZUGSWEISE BEHANDELT AN BARIUMKALZIUMWOLFRAMAT-WOLFRAM-FORMKOERPERN]
Dietrich Schmidt (Ph.D. Thesis—Tech. Hochschule Karlsruhe) Dec. 1969 99 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-96) Avail: CFSTI

Cermet electrodes for a low temperature range (Ba2.5Ca0.5W06-W) and for higher operating temperatures (UO2-Mo) were manufactured with reproducible structure. The operating temperature and time, the gas at the surface of the emitter and its partial pressure, the combination of the emitter material and the addition of small amounts of other metals affected the work function. Assuming that the degree of coverage of the surface is a criteria for the emission current, all the temperature functions of the work function of the two systems can be explained by a model which is discussed. Author (ESRO)

N70-27614 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRON-PROBE ANALYSIS OF GAMMA AND GAMMA-PRIME PHASES IN MULTICOMPONENT NICKEL ALLOYS
L. A. Ryabtsev et al 19 Jan. 1970 9 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (Moscow), v. 27, no. 5, May 1969 p 812 - 815 In RUSSIAN and ENGLISH
(NLL-Trans-746-398-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The technique of electron probe analysis was found to give satisfactory accuracy in determinations of the distribution of alloying elements between the gamma and gamma prime phases. The results are in agreement with the data obtained earlier by microstructural and X-ray diffraction analyses. Using these results, pure gamma and gamma prime phases were synthesized for all alloys investigated. Author

N70-27615 National Lending Library for Science and Technology, Boston Spa (England).
INFLUENCE OF PARTICLE SIZE DISTRIBUTION OF CARBONYL NICKEL POWDERS ON THE STRUCTURE OF SINTERED BASES FOR ACCUMULATOR ELECTRODES
S. M. Rakhovskaya et al 19 Jan. 1970 19 p refs Transl. into ENGLISH from Proshkovaya Met., Akad. Nauk Ukr. SSR (Kiev), v. 9, no. 7, Jul. 1969 p 86 95 In RUSSIAN and ENGLISH
(NLL-Trans-746-355-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

Sedimentation analysis, filtration of air, and low temperature adsorption of nitrogen were used in characterizing the degree of dispersion and the sizes of the specific surface of light carbonyl nickel powders with specific volumes of 1.1-2.06 cu cm/g. Microscopical investigations of the powders were conducted on an MBI-6 optical microscope and on an electron microscope. Pictures were prepared by free powder filling on a glass backing plate and by stripping replicas followed by partial or complete etching of the film in hydrofluoric acid. J.M.C.

N70-27831# Argonne National Lab., Ill. Metallurgy Div.
COMPATIBILITY OF URANIUM-5 w/o FISSIUM ALLOY WITH TYPES 304L and 316 STAINLESS STEEL
S. Thomas Ziegler, Howard V. Rhude, Jr., and John A. Lahti Sep. 1969 15 p refs
(Contract W-31-109-eng-38)
(ANL-7596) Avail: CFSTI

The compatibility of uranium-5 wt % fissium alloy with two types of stainless steel was investigated in diffusion-couple annealing experiments conducted at temperatures to 650 C. Types 304L and 316 stainless steel are equally compatible with the uranium-fissium alloy. Penetrations of diffusing elements into the steels ranged from a maximum of 7 micron at 550 C to a maximum of 30 micron at 650 C. Type 304L stainless steel reacts slowly with the fuel alloy to form a liquid phase at 705 + or 5 C, and Type 316 stainless steel does so at 715 + or 5 C. Higher concentrations of silicon and aluminum in the fissium alloy have no effect on the compatibility of the alloy with Type 304L stainless steel at 650 C, but the temperature at which a liquid slowly forms is increased to 725 + or 5 C. Author (NSA)

N70-27664# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.
A STUDY OF THE MECHANISM OF STRESS CORROSION CRACKING IN THE IRON-NICKEL-CHROMIUM ALLOY SYSTEM Quarterly Report, 17 Jun. – 16 Sep. 1968
R. W. Staehle 8 Sep. 1969 38 p refs
(Contract AT(11-1)-1319)
(COO-1319-79) Avail: CFSTI

The predictions of work from straining electrode studies have been tested by conducting stress corrosion cracking (SCC) tests at constant potential and an excellent correlation was found between these predictions and the occurrence of SCC. This correlation implies that a scoping test may be possible which would obviate the necessity for the usual large number SCC tests. Also testing of a variety of alloys having an iron base with 10–15Cr, 10–15Ni and Be, C, or Al additives shows a number of excellent possible alloys for resisting chloride SCC. Certain alloys have a virtually infinite life. Author (NSA)

N70-27691# Army Weapons Command, Rock Island, Ill. Research and Engineering Directorate.
DETERMINATION OF BERYLLIUM IN ALUMINUM ALLOYS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
Elizabeth A. Peterson Oct. 1969 10 p refs
(AD-700880; TR-70-109) Avail: CFSTI CSCL 11/6

A method is described for the determination of beryllium in aluminum alloys. The samples are dissolved in hydrochloric acid with the addition of peroxide. Agreement with certified values on standard samples was good. Author (TAB)

N70-27694# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
INTERPRETATION OF THE ASME CODE FOR LOW-ALLOY STEEL IN BIMETALLIC SODIUM SYSTEMS
F. A. Comprelli and J. L. Krankota Sep. 1969 14 p refs
(Contract AT(04-3)-189)
(GEAP-13545) Avail: CFSTI

An analysis was made of the allowable stress and strain rate criteria. Particular emphasis was directed at the application of these criteria to the design limits for low-alloy steels in bimetallic sodium systems. Design limits were estimated for several feasible interpretations of the Code for several decarburizing conditions. Comment is also offered on the advisability of a strain or strain-rate controlled design limit under these conditions. Author (NSA)

N70-27741# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering.
A STUDY OF DISLOCATION MOBILITY AND DENSITY IN METALLIC CRYSTALS Annual Summary Report, Period Ending Jul. 1969
T. Vreeland, Jr. and David S. Wood Jul. 1969 9 p refs
(Contract AT(04-3)-767)
(CALT-767-P-3-7; ASR-7) Avail: CFSTI

The deformation processes which occur in crystalline solids are studied to identify and understand the various mechanisms causing drag on moving dislocations, and to relate these mechanisms to the macroscopic aspects of plastic deformation. Dislocation mobility in single crystals is measured as a function of stress and temperature. NSA

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N70-28521# Gulf General Atomic, San Diego, Calif.
RESEARCH ON GRAPHITE Quarterly Progress Report, Period Ending 14 Nov. 1969
G. B. Engle, J. C. Bokros, and R. J. Price 20 Nov. 1969 24 p refs
(Contract AT(04-3)-167)
(GA-9828) Avail: CFSTI

Calcined cokes are being separated in a densitometer and heat treated to determine the effect of the calcined particle density on the graphitizability of the structure. Attempts were made to separate a pyrolytic carbon impregnant from Poco base stock in the densitometer, but the two materials were too much alike to achieve separation. Aluminum-doped petroleum coke was prepared and formed into carbon compacts with a pitch binder. After heating for 6 hr at 2300 C, up to 73 wt-% of the carbon structure was converted to graphite in the compacts where the original aluminum content was about 17 wt-%. The aluminum evolved from the compact during the heat treatment. Two series of graphite specimens are currently under high-temperature irradiation in the Engineering Test Reactor (ETR). The next scheduled capsule discharge date is December 1969. Author (NSA)

N70-28529# Army Materials and Mechanics Research Center, Waterton, Mass.
ALLEVIATION OF THE SILICIDE PEST IN A COATING FOR THE PROTECTION OF REFRACTORY METALS AGAINST HIGH TEMPERATURE OXIDATION Technical Report
Joseph J. Falco and Milton Levy Dec. 1969 15 p refs
(AD-701076; AMMRC-TR-69-30) Avail: CFSTI CSCL 11/3

Pure and alloyed silicide coatings offer some of the most promising means of protecting the refractory metals from high temperature oxidation. In the intermediate temperature range, however, they are prone to rapid disintegration of the bulk material which has been termed 'silicide pest'. Studies of the mechanisms of protection and failure of a modified disilicide coating for a 90 Ta-10 W alloy have evolved a simple method for alleviating the silicide pest by a preoxidation treatment. Author (TAB)

N70-28588*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THERMAL CRACKING OF PHENOLIC-NYLON PYROLYSIS PRODUCTS ON PASSING THROUGH A HEATED CHAR
George F. Sykes, Jr. Washington May 1970 18 p refs
(NASA-TN-D-5804; L-6992) Avail: CFSTI CSCL 11E

The pyrolysis products were generated by flash pyrolysis of the heat shield material in front of the heated char and were analyzed, after passing through the char, by gas chromatography. The change in composition of the pyrolysis products after passing through the char showed that the high molecular weight products cracked to lower molecular weight products, beginning at about 700 C. The low molecular weight products were found to increase with increasing char temperature and, at char temperatures approaching 1000 C, the pyrolysis gases were composed of carbon dioxide, carbon monoxide, water, methane, hydrogen, acetylene, benzene, and cyclopentanone. Author

N70-28689 Stevens Inst. of Tech., Hoboken, N.J.
COLD DRAWING BEHAVIOR OF POLYTETRAFLUORETHYLENE
George Ping-Shan Koo (Ph.D. Thesis) 1969 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-21294

The cold drawing (or plastic yield) behavior of polytetrafluoroethylene around the −97 C, 19 C and 127 C transitions was investigated. Experimental procedures were based primarily on stress-strain and tensile creep measurements. The effect of degree of crystallinity and morphology was also investigated. The first order transition around room temperature was of particular

interest. The investigation revealed that the effect of stress and of temperature on creep compliance were qualitatively equivalent around this transition; this was similar to the stress-temperature equivalence previously observed around the second order transition of amorphous polymers. The results suggest that the general characterization of the solid-state structure of a semi-crystalline polymer should include specifying the nature of each phase, i.e., whether the amorphous phase is glassy or rubbery, and whether the crystalline phase is rigid or plastic, as well as specifying the percent of each phase. Dissert. Abstr.

N70-26729# Princeton Univ., N.J. Chemical Lab.
THE EQUATION OF STATE FOR RUBBER ELASTICITY: THE EFFECT OF SWELLING ON THE FRONT FACTOR Technical Report
J. C. Goebel and A. V. Tobolsky Dec. 1969 16 p refs
(Contract N00014-67-A-0151-0011)
(AD-700713; ONR-TR-RLT-119) Avail: CFSTI CSCL 7/4

The front factor in the equation of state for rubber elasticity has been measured for a poly (dimethylsiloxane) network swollen in a series of swelling agents. The intrinsic viscosity of a linear poly (dimethylsiloxane) polymer in these swelling agents was also measured. Comparison of the intrinsic viscosity and front factor values indicate that the change in modulus of the network upon swelling arises from the change of preferred conformation of the network chains due to interaction with the swelling agent. Author (TAB)

N70-26775# Rensselaer Polytechnic Inst., Troy, N.Y.
VISCOSITY AND ELECTRICAL CONDUCTIVITY OF GLASSES AT CONSTANT VOLUME Final Report, 1 Oct. 1968–31 Aug. 1969
John D. Mackenzie 31 Aug. 1969 14 p refs
(Contract F44620-69-C-0041)
(AD-701746; AFOSR-70-0461TR) Avail: CFSTI CSCL 11/2

A technique of measuring ionic conductivity as a function of temperature as well as pressure was developed. Results were obtained for simple borate systems from the solid glassy state to the molten state up to 5000 psi. The most important observations were that both the activation energy and the activation volume for conduction appeared to attain maximum values at temperatures near the glass-transition point. A new method of measuring viscosities of glasses such as boric oxide and related glasses was developed by firing a projectile into the molten glass and measuring the penetration depth. At relatively low viscosities self healing fractures occurred. Author (TAB)

N70-26802# California Univ., Berkeley. Structural Engineering Lab.
THE FINITE ELEMENT ANALYSIS OF PHYSICALLY AND KINEMATICALLY NONLINEAR ELASTIC SOLIDS
Kenneth T. Kavanagh Apr. 1969 138 p refs
(Contract DACW68-67-C-0004)
(AD-701897; SEL-69-4) Avail: CFSTI CSCL 11/9

A displacement formulation of the finite element method is applied to the analysis of physically and kinematically nonlinear elastic solids. The physical nonlinearity is represented by an approximate polynomial form of the strain energy function in a region about the natural unstressed state of the material. Solutions to the nonlinear equations are obtained through a variety of linearization techniques. Several such techniques, based on either a sequence of linear iterations or a sequence of linear increments, are compared with respect to computational efficiency. TAB

N70-26811# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VAP-2 ANTIFRICTION COATING
L. A. Gaevskii 20 Aug. 1969 5 p Transl. into ENGLISH from Byull. Tekh.-Ekon. Informatsii (Moscow), no. 8, 1967 p 9
(AD-700604; FTD-HT-23-450-68) Avail: CFSTI CSCL 11/8

The VAP-2 antifriction coating, a hard lubricant consisting of molybdenum disulphide and EP-074 epoxy lacquer in a ratio of 1 to 2 (calculated to lacquer dry residue), was developed. The VAP-2 lubricant is recommended for machine parts working in a medium of various oils at temperatures below 250C, stainless-steel and titanium parts working below 200C, aluminum- and cadmium-plated low-carbon steel parts below 80 degrees centigrade, and bronze parts below 60C. Parts coated with VAP-2 were operated at 250C for 400 hr and no change in coating was observed. Coatings on stainless-steel and titanium parts with a previously pickled surface were in the best condition. Corrosion tests outdoors under the effect of rainfall showed VAP-2 coatings to be very satisfactory, especially on stainless-steel, titanium, and parkerized specimens. Author (TAB)

N70-26824# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF PREPARATION OF PHOSPHATES FOR PREVENTING CORROSION OF METALS
Pao-ting Hua et al 8 Aug. 1969 9 p Transl. into ENGLISH from Chung Kuo k'o Hsueh Yuan, Ying Yung Hua Hsueh Yen Chiu So Chi K'an (Chinese), no. 5, 1961 p 81–82
(AD-700793; FTD-HT-23-1304-68) Avail: CFSTI CSCL 11/6

The article reports the study of preparing hydrous ferromanganese dihydrogen phosphate as used for the inhibition of metallic corrosion with ferromanganese powder and phosphoric acid as raw materials. The yield is about 80 percent on the basis of ferromanganese. The liquid can be used over and over again if the required quantities of ferromanganese and phosphoric acid are added during reuse. They can be calculated from a graph included in this article. Author (TAB)

N70-26834# Army Weapons Command, Rock Island, Ill. Research and Engineering Directorate.
LUBRICATION AND PHYSICAL PROPERTIES OF FLUOROCARBON FLUIDS
George P. Murphy, Jr. and Charles J. Quilty Nov. 1969 39 p refs
(AD-701012; AMSWE-RE-70-110) Avail: CFSTI CSCL 11/8

Nine fluorocarbon fluids representing four classes of fluorinated organic liquids were compared with the base fluids for the present specification weapons lubricants. Wear, friction, load-carrying capacity, and physical property data show that several of the fluorocarbon fluids are superior to the weapons lubricant base fluids. The best fluorocarbon fluids are the trifluoropropylmethyl polysiloxanes and the polyhexafluoropropylene oxides. The effects of the addition of antiwear and corrosion inhibitors on the trifluoropropylmethyl polysiloxanes was investigated. It was shown that, under certain conditions, the addition of perfluoroalkyl acids improve the antiwear and frictional properties characteristics of the fluorocarbon fluid. Good corrosion inhibiting characteristics of the fluorocarbon fluid are obtained by the addition of a perfluoroalkyl phosphate ester. The antiwear and the extreme pressure properties of trifluoropropylmethyl polysiloxane and polyhexafluoropropylene oxide are not dependent on a reaction between the fluorine molecule and the substrate. Author (TAB)

N70-26845# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRODUCTION AND IMPROVEMENT OF THE QUALITY OF PLASTIC LUBRICANTS
8 Oct. 1969 10 p refs Transl. into ENGLISH from Neftepererab. i Neftekhimiya (USSR), no. 9, 1968 p 63–64
(AD-700377; FTD-MT-24-193-69) Avail: CFSTI CSCL 11/8

A brief summary is presented of the activities of a conference on the manufacture and improvement of plastic lubricants. The conference was held in Leningrad from April 23-25, 1968. TAB

N70-26920# Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT AND EVALUATION OF HOT ISOSTATICALLY COMPACTED BORON NITRIDE Triannual Report, 30 May – 30 Sep. 1969
M. C. Brockway and D. E. Niesz Jan. 1970 22 p refs
(Contract DAAB07-69-C-0133)
(AD-700976; ECOM-0133-2) Avail: CFSTI CSCL 11/2

Six commercial boron nitride powders were consolidated by hot isostatic compaction (HIC) into cylindrical test samples. Three conditions were employed for consolidation: 3000 F, 30,000 psi; 3600 F, 14,000 psi; and 4500 F, 15,000 psi. BN sample densities ranged up to 97.4 percent of theoretical. Maximum tensile strength (measured by diametral compression) reached 2700 psi. D-c electrical resistivity exhibits values in the 10 to the 14th power ohm/cm range and dielectric strength varied between 700 and 1200 volts/mil. Samples are now in preparation to obtain a-c electrical properties. Author (TAB)

N70-26964# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHEMILUMINESCENT METHOD FOR STUDYING THE THERMAL STABILITY OF MOTOR OILS WITH ADDITIVES
F. G. Suleimanova et al 18 Sep. 1969 10 p refs Transl. into ENGLISH from Azerb. Neft. Khoz. (USSR), v. 47, no. 3, 1968 p 42–43
(AD-700374; FTD-HT-23-117-69) Avail: CFSTI CSCL 11/8

The chemiluminescent method of process control was applied to the study of thermal stability of lubricating oils, and an apparatus was constructed for subjecting small samples of oils to the oxidation at elevated temperatures and recording the levels of chemiluminescence. Two different procedures were used in the study. In the first, the sample of a mineral base for the oils was heated at steps of 10 degrees in the range of 120-200 degrees, and the time of the emission at each temperature was recorded. In the second procedure the intensity of the chemiluminescence resulting from the oxidation of the oil sample is recorded at various temperatures over the same period of 10 sec. Nine additives were evaluated, and the most pronounced antioxidant effect was that of the INKhP-21 additive. Author (TAB)

N70-26965# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN SSSR SCIENTIFIC COUNCIL ON FRICTION AND LUBRICANTS. SCIENTIFIC PRINCIPLES AND NEW METHODS OF TESTING MATERIALS FOR FRICTION POINTS: SELECTED ARTICLES
A. A. Blagonravov et al 23 Sep. 1969 30 p Transl. into ENGLISH from the book "Nauchnye Printsipy i Novye Metody Ispytanii Materialov Dlya Uzlov Treniya" Moscow, Nauka, 1968 10 p
(AD-700650; FTD-MT-24-163-69) Avail: CFSTI CSCL 11/8

Contents: Friction and wear theory; Method of testing radiation wear resistance of polymer coatings applied by the rotaprint method; and Experimental installation for the investigation of wear resistance of toothed friction pairs with a rotary lubrication system operating in a vacuum at increased temperatures. TAB

N70-26995# Sandia Corp., Albuquerque, N. Mex.
SOME OBSERVATIONS ON THE INFLUENCE OF GRAPHITE MICROSTRUCTURE ON ABLATION PERFORMANCE
D. F. McVey, I. Auerbach, and D. D. McBride New York AIAA [1969] 19 p refs Presented at AIAA 8th Aerospace Sci. Meeting, New York, 19–21 Jan. 1970 Sponsored by AEC *Its* AIAA Paper No. 70-155
(SC-DC-69-1976; Conf-700103-1) Avail: CFSTI

Several graphite materials were tested in arc heaters at different stagnation pressure and enthalpy conditions. Pre- and posttest examinations of the material surface and internal structures were made by radiography, mercury and Quantimet porosimetry, helium permeability, electron scanning and optical microscopy, X-ray diffraction, and surface roughness analysis. The microstructural data, along with the relative ablation performance were used to show the correlation between microstructure and ablation performance. The major influences are grain size, porosity, and degree of graphitization. The ablation mechanism involves enhanced removal of binder material with resultant grain exposure and subsequent removal of particulate matter. Author

N70-27013# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
CONSEQUENCES OF ENVIRONMENTALLY INDUCED DILATION IN SOLIDS Technical Report, Dec. 1967 – Aug. 1968
J. C. Halpin and N. J. Pagano Dec. 1969 32 p refs
(AD-701725; AFML-TR-68-395) Avail: CFSTI CSCL 11/4

The deformation of a solid induced by swelling is equivalent to that caused by a temperature change. A generalized Duhamel-Neumann form of Hookes law is employed to treat a wide variety of environmental problems by the joint application of solid mechanics and elementary physical chemistry. This approach is illustrated for a swollen fiber reinforced material, employing physical chemistry concepts, micromechanics, and laminated anisotropic plate theory. The specific results are applicable to the design of dimensionally stable composite materials in variable thermal or swelling environments. A new strain invariant for laminates under these types of environments is also introduced. Author (TAB)

N70-27031# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
CHARACTERIZATION OF CARBONS AND GRAPHITES THROUGH ANALYSIS OF THE (001) X-RAY INTERFERENCE
N. Christu et al [1969] 20 p refs Transl. into ENGLISH from Carbon (London), v. 7, 1969 p 397–411
(ONRL-tr-2209) Avail: CFSTI

Studies continued on the characterization of carbon and graphite by X-ray diffraction on powder samples. Efforts were concentrated on the profile analysis of the X-ray diffraction maxima by use of the Warren-Averbach method for separation of the crystallite size and lattice distortion contributions. The goal of the studies is to determine whether: (1) A constant distortion contribution may be assumed for the crystallite size determination of the various carbons, (2) to assign an additional importance to the separately determined distortion portion for characterization studies and, for example, arrive at an understanding of the graphitization process. Author

N70-27050# Sandia Corp., Albuquerque, N. Mex.
CARBON COMPOSITES FROM WOOL FELT SUBSTRATES
H. O. Pierson and J. F. Smatana Sep. 1969 20 p refs
(SC-DR-69-530) Avail: CFSTI

The development of carbon composites obtained by chemical vapor deposition of carbon on a carbonized wool substrate is described, as well as the study of the carbonization of wool, the deposition parameters, and the effects of high temperature heat treatment. The mechanical, thermal, and ablation properties of these composites are described. These composites showed a substantial increase in strength over conventional rayon felt based composites prepared under the same infiltration conditions. Author (NSA)

N70-27168*# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF SPACE-STABLE THERMAL-CONTROL COATINGS, 1 MAY – 30 SEPTEMBER 1969

N. A. Ashford and G. A. Zerlaut 17 Nov. 1969 37 p refs
(Contract NAS8-5379; IITRI Proj. U6002)
(NASA-CR-102653; IITRI-U6002-83) Avail: CFSTI CSCL 11C

The development of thermal-control surface coatings that possess very low stable ratios of solar absorptance to infrared emittance is investigated with emphasis on zinc orthotitanate. Extensive EPR investigations of variously treated zinc orthotitanate pigments, and percusor oxides are reported with the results of X-ray diffraction. It is concluded that zinc oxide in small amounts stabilizes zinc orthotitanate from optical damage. F.O.S.

N70-27170*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SURFACES FOR MICROMETEOROID IMPACT CRATER DETECTION
Donald E. Brownlee (Washington Univ., Seattle) and Paul W. Hodge (Washington Univ., Seattle) 20 Feb. 1970 22 p refs
(Grant NGR-48-002-033)
(NASA-CR-109729; SAO-SPECIAL-Rept-308) Avail: CFSTI CSCL 11D

Because of the importance of increasing the sensitivity of micrometeoroid-detection experiments, a Van de Graaff microparticle accelerator was used to investigate the general properties of micron-sized impact craters in various surface types. Of the 22 surfaces studied, glass, Au film on lucite, and Al film on glass were found highly efficient in displaying impacts and could be used for statistically meaningful determinations of flux and species in spite of the low particle flux implied by many recent rocket and satellite measurements. Author

N70-27217# Scientific Translation Service, Ann Arbor, Mich. Oak Ridge National Lab., Tenn.
VARIOUS EXPERIMENTAL PROBLEMS AND REINVESTIGATION OF EXPERIMENTAL RESULTS RELATIVE TO THE HEAT TREATMENT OF CARBON UNDER HIGH PRESSURE
Michio Inagaki et al [1968] 20 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Japan), v. 71, 1968 p 652–657
Avail: CFSTI

The (004) diffraction pattern of heat treated carbon under high pressure was recorded and analyzed. When the proportion of component lattices was determined from the overlapping (002) and (004) diffraction patterns, appropriate correcting steps were taken to determine the selective orientation of the crystallite. The results obtained agree well with those reported earlier for the (002) diffraction lines. Author

N70-27226# Westinghouse Electric Corp., Pittsburgh, Pa. Material Sciences Dept.
NON-ELASTIC DEFORMATION DURING FRACTURE OF GLASS Technical Report
F. F. Lange 15 Feb. 1970 16 p refs
(Contract N00014-68-C-0323)
(AD-702474; TR-3) Avail: CFSTI CSCL 11/2

Micrographs of glass fracture surfaces are presented that unambiguously show that non-elastic deformation takes place during crack propagation. These observations are of bent fragments still attached to straight fracture steps that are usually found on fracture surfaces. The mechanism of step formation leading to bent fragments is presented in relation to reported mechanisms of similar fragments (viz., cleavage whiskers) formed on fracture surfaces of quasi-brittle materials (e.g., MgO). These observations are discussed with reference to several non-elastic deformation mechanism that might occur in glass. Author (TAB)

N70-27360*# Battelle Memorial Inst., Columbus, Ohio.
PREDICTION OF SERVICE LIFE OF POLYMERIC SEALANT COMPOSITIONS FOR FUEL TANKS IN AEROSPACE STRUCTURES FROM MEASUREMENTS OF VISCOELASTIC PROPERTIES Annual Report
John A. Hassell, Kenneth A. Boni, Henry W. Kuhlmann, and E. R. Mueller Aug. 1969 63 p
(Contract NAS8-21398)
(NASA-CR-102658) Avail: CFSTI CSCL 11A

Test methods aimed at the prediction of service life of polymeric sealant compositions for fuel tanks in aerospace structures from measurements of viscoelastic properties are discussed. The effects of aging on various rheological and physical properties of three representative sealants were measured. The properties chosen for measurement were: (1) weight and volume; (2) Shore A hardness; (3) tensile strength and stress relaxation; (4) torsional damping; and (5) single lap shear strength. The changes in these properties, caused by aging of the sealants in various environments and temperatures, were used to determine the mechanisms of sealant degradation that would lead to a fuel leak. Aging of all three sealants in fuel indicates that at least two mechanisms of aging occurred (and that a simple empirical or theoretical rate equation will not describe these mechanisms). An analysis of the possible stresses and strains that may be expected in a fuel tank configuration reveals that stresses and elongations are large enough so that rupture of cohesive or adhesive bonds can occur. A critical factor related to a fuel leak is the rate at which these tears or cracks propagate. Author

N70-27396# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF TEMPERATURE ON THE MECHANICAL PROPERTIES OF UNIDIRECTIONAL FIBERGLASS REINFORCED PLASTIC
Y. V. Bilida 17 Sep. 1969 8 p Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR, Ser. A (Kiev), v. 30, no. 3, 1967 p 259–262
(AD-701233; FTD-HT-23-1211-68) Avail: CFSTI CSCL 11/9

The mechanical properties of glass fiber-reinforced plastic having fibers oriented in one direction and made with epoxy resin, were studied by stretching at 293-473 degrees K. With increasing temp. the elasticity modulus and, in a more pronounced manner, the tensile strength of the plastic decreased, while the elongation at break remained practically unchanged. Author (TAB)

N70-27399# National Bureau of Standards, Washington, D.C. Building Research Div.
EXPOSURE TEST, 1964, OF PORCELAIN ENAMELS ON ALUMINUM: THREE YEAR INSPECTION
Margaret A. Baker Apr. 1970 13 p refs *Its* Bldg. Sci. Ser. 29
(NBS-BSS-29) Avail: SOD $0.25 Catalog No. C 13.29/2:29

An exposure test of porcelain enamels on aluminum was initiated in 1964. The enamels were returned from the exposure sites to the laboratory to be measured for changes in gloss and color after exposures of six months, one year, and three years. Changes were found to be greatest at Kure Beach and least at Montreal and Los Angeles, with moderate changes occurring at Washington and New York. Although the boiling citric acid test is used as an acceptance test for these enamels, the correlation with color change, particularly at Kure Beach, was not as good as expected. A cupric chloride test was developed which shows an improvement in this correlation. Author

N70-27426*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.
OUTGASSING STUDIES ON SOME POLYMER SYSTEMS FOR GSFC COGNIZANT SPACECRAFT
Aaron Fisher and Benjamin Mermelstein Feb. 1970 15 p refs
(NASA-TM-X-63894; X-735-70-73) Avail: CFSTI CSCL 11I

The data presented in this document indicate that many glass-filled thermoplastic polymers (potential structural materials for space applications) have very low outgassing profiles and that two room temperature curing silicone potting compounds are also in this category. Many elastomeric type silicones are entirely suitable after high temperature post cure. Methacrylates have been shown acceptable as optical elements. This document also presents results on some miscellaneous functional systems. Author

N70-27444# Defense Documentation Center, Alexandria, Va.
LUBRICANTS FOR USE IN THE SPACE ENVIRONMENT, VOLUME 1 BIBLIOGRAPHY
Mar. 1970 117 p refs
(AD-702550; DDC-TAS-70-8-Vol-1) Avail: CFSTI CSCL 11/8

The document contains 86 annotated references on lubricants for use in space environments. References were selected from the Defense Documentation Centers collection and cover the period from January 1960 to December 1969. Corporate Author-Monitoring Agency, Subject and Contract Number indexes are included. Author (TAB)

N70-27478# Quantum Inc., Wallingford, Conn.
DEVELOPMENT OF LOW TEMPERATURE CURE COATING FOR EXTERNAL SURFACES OF NAVAL AIRCRAFT Final Report, 1 Aug. 1968 – 1 Aug. 1969
J. S. Roscoe and B. F. Clark 8 Aug. 1969 52 p
(Contract N00019-69-C-0080)
(AD-701768) Avail: CFSTI CSCL 11/3

An improved ester-modified polyamide-imide resin system having low-temperature (50-80C) curing characteristics for use as coating for external metal surfaces of naval aircraft was developed. Evaluation tests were conducted using a wide variety of curing agents. Processing parameters were established. An effective stripper was selected for removal of cured coatings. Author (TAB)

N70-27634*# Whittaker Corp., San Diego, Calif. Research and Development Div.
NON-FLAMMABLE GLASS REINFORCED PLASTIC MATERIAL FOR STRUCTURAL APPLICATIONS Final Report, 17 Feb. 1969 – 17 Feb. 1970
Charles L. Segal 17 Feb. 1970 17 p
(Contract NAS9-9273)
(NASA-108441) Avail: CFSTI CSCL 11D

Nonflammable reinforced structural composites were prepared from polyquinoxaline resin and glass fabric. A most important finding was that even thin laminates of this composition were self-extinguishing when tested in high pressure oxygen environments. Independent reports had shown that thicker laminates made with PQ or other aromatic heterocyclic polymers were also self-extinguishing. While laminates with low void and excellent mechanical performance could be prepared by press curing at 200 psi and 750 F, laminates with acceptable mechanical strength could be prepared under vacuum bag conditions of 15 psi and 500 F. The later procedure led to higher voids, but still yielded a self-extinguishing laminate. Exposure to environmental extremes did not affect the composite. Author

N70-27558*# Scientific Translation Service, Santa Barbara, Calif.
STRUCTURES AND STRUCTURAL METHODS USING NEW FIBER-REINFORCED COMPOSITE MATERIALS, WITH SPECIAL ATTENTION GIVEN TO BORON FIBERS [STRUKTUREN UND BAUWEISEN AUS NEUARTIGEN FASERVERBUNDSTOFFEN UNTER BESONDERER BERUECKSICHTIGUNG DER BORFAEDEN]
R. Kochendoerfer Washington NASA Apr. 1970 15 p refs Transl. into ENGLISH from Raumfahrtforsch. (Stuttgart), v. 13, Jul. – Aug. 1969 p 175 – 180
(Contract NASw-2035)
(NASA-TT-F-12841) Avail: CFSTI

Demonstration of the field of application of boron- and carbon-reinforced composite materials by project studies and parts already introduced in the aerospace field. Weight savings of up to 60 per cent compared with conventional metal constructions are achieved. Various aerospace components made of the new composite materials are discussed with respect to their special structure design and the problems of connection and load input. For lightweight structures a mesh type boron fiber design concept is introduced. Author

N70-27564# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany). Inst. fuer Fluctreib- und Schmierstoffe.
INVESTIGATION OF AIRCRAFT TURBINE OILS FROM AIRCRAFT ENGINES [UNTERSUCHUNG VON FLUGTURBINENOELEN AUS FLUGTRIEBWERKEN]
Eilhard Jantzen Feb. 1970 34 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-07) Avail: CFSTI

Oil samples from two aircraft turbine engines in operation were investigated. Sampling was done in part over a period up to 2300 flying hours. The prime purpose of these investigations was to determine whether even slight changes in aircraft engine oils may firmly be established by analytical methods. In addition, the studies were made to determine whether a significant increase of changes occurred in spite of refuelling and to obtain a potential limit of application. Author (ESRO)

N70-27566# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
ELASTIC AND PLASTIC DEFORMATION OF SOLIDS Annual Progress Report, 1 Feb. 1969 – 31 Jan. 1970
Arthur L. Ruoff 22 Sep. 1969 12 p refs
(Contract AT(30-1)-2504)
(NYO-2504-70) Avail: CFSTI

Continuing research is briefly reported. The areas of investigation include the following: elastic constant data on rubidium halides; self diffusion in aluminum; spin lattice relaxation times of lithium in LiBr crystals; creep in aluminum, iron and copper; elastic constants of metals and alkali halides; length change measurement under pressure; acoustic velocity measurement; and least squares curve-fitting of nonlinear functions. N.E.N.

N70-27600# Princeton Univ., N.J. Frick Chemical Lab.
A NOTE ON STRESS RELAXATION OF RUBBER NETWORKS IN THE VICINITY OF ROOM TEMPERATURE
Gail R. G. Steiner and Arthur V. Tobolsky Feb. 1970 11 p refs
(Contract N00014-67-A-0151-0011)
(AD-702479; ONR-TR-RLT-121) Avail: CFSTI CSCL 11/10

Stress relaxation of dicumyl peroxide cured natural rubber was measured at temperatures ranging from room temperature to 100C, both in air and in vacuum. The results indicate that finite equilibrium values do exist for samples tested in the absence of oxygen. Author (TAB)

N70-27601# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
QUANTITATIVE ANALYSIS OF MIL-H-27601 FLUID FOR TRICRESYL PHOSPHATE AND 4,4' -METHYLENE BIS (2,6-DI-TERTBUTYL PHENOL) BY INFRARED SPECTROSCOPY Technical Report, Nov. 1967 – Jan. 1969
William J. Crawford, Keith Burris, and John McCaffrey (Dayton Univ.) Jan. 1970 21 p refs
(AD-702496; AFML-TR-69-260) Avail: CFSTI CSCL 11/8

An infrared method for the quantitative analysis of 4,4-methylene-bis (2,6-di-tertbutyl phenol) and tricresyl phosphate ir

hydraulic fluid MIL-H-27601 is reported. The method is quick and easily performed using a low-cost infrared spectrophotometer. With this method the change in additive content when the MIL-H-27601 is exposed to stress fluid tests can be determined. Author (TAB)

N70-27644# Denver Univ., Colo. Dept. of Metallurgy and Materials Science.
COMPUTER MODELS OF POLYETHYLENE SPERULITES
A. W. Thornton and Paul K. Predecki [1969] 21 p refs Supported by NSF and the Petrol. Res. Fund
Avail: Issuing Activity

In order to account for the morphology observed in surface replicas of polyethylene spherulites, two possible models are proposed. These are based on the efficiency of packing of twisted lamellar fibrils and on the requirement that lamellae of constant twist angle form continuous surfaces. A computer was used to take sections through the model spherulites and to plot out the ring structure to be expected on a surface replica. On all sections not passing through the spherulite center, both models show a double-armed spiral form with a large center, in keeping with observed structures. Sections passing through the centers of the model spherulites do not always give double-armed spirals, depending on the model. This is in general agreement with experiment; however, the observed morphology on such sections contains enough radial faults to make a choice between the two models uncertain at present. Author

N70-27645# Denver Univ., Colo. Dept. of Metallurgy and Materials Science.
OBSERVATIONS OF DEFORMATION IN SPHERULITIC POLYETHYLENE
A. W. Thornton and Paul K. Predecki [1969] 20 p refs Supported by NSF and the Petrol. Res. Fund
Avail: Issuing Activity

A thin film marker technique is described for determining quantitatively from replicas the nonhomogeneous deformation modes operative in spherulitic polyethylene. Experiments were conducted at temperatures and strain rates corresponding to the beta, alpha, and alpha prime relaxations in polyethylene. From the results it is concluded that the beta relaxation is due to spherulite boundary deformation. This results in stress concentrations which cause the accompanying nonhomogeneous deformation of the spherulites themselves to occur. The alpha relaxation is found to be due to homogeneous deformation within lamellae and the alpha, prime to lamellar boundary slip, in agreement with the results of other investigators. Author

N70-27793# National Lending Library for Science and Technology, Boston Spa (England).
SUITABILITY TESTS OF HOLLOW BODIES MADE OF SYNTHETICS AS PACKING MATERIALS
Marl Gerhard Binder 28 Nov. 1969 17 p refs Transl. into ENGLISH from Neue Verpackung (German), v. 19, no. 9, Sep. 1966
(NLL-M-7932-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

Hollow bodies are tested for suitability by judging either the basic raw material properties or the quality of the finished packing piece. Factors determining the initial selection of raw materials are: resistance to chemicals and tension crack resistance; permeability to gases, vapors, and light transmission; mechanical properties; impact tests; bracketing; falls at constant heights; internal, piling, sealing, and compression pressure; transport tests; bottling, sealing, and durability. S.S.

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N70-28507 New York Univ., N.Y.
TRACE NORMS, GLOBAL PROPERTIES AND DIRECT INTEGRAL DECOMPOSITIONS OF W-* ALGEBRAS
Paul Mitchell Willig (Ph.D. Thesis) 1969 64 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-21281

Let A be a W-* algebra acting in a separable Hilbert space h, and let its direct integral decomposition into factors be given. If A is of pure type 2, a form for trace norms in A is obtained, and continuity of these norms with respect to the strong operator topology is proved. Dissert. Abstr.

N70-28508# California Univ., Los Angeles.
STONE LATTICES
Raymond Balbes and Alfred Horn [1969] 17 p refs Submitted for publication Prepared in cooperation with Missouri Univ., St. Louis
(Grant NSF GP-9044)
Avail: Issuing Activity

A Stone lattice is a pseudo-complemented distributive lattice. The problem of characterizing such lattices was raised by M. H. Stone. It is shown that a lattice is a Stone lattice if and only if it is a * sublattice of a direct product of dense distributive lattices with 0 and 1. Also characterized are relative Stone lattices with 1 as yielding sublattices of direct products of linearly ordered sets with 1. A description of free Stone lattices is given. In particular, a free Stone lattice with finitely many free generators is a direct product of free distributive lattices to which 0 and 1 are adjoined. Author

N70-28523# Arizona Univ., Tucson.
CAUCHY'S EQUATION AND SUFFICIENT STATISTICS ON ARCWISE CONNECTED SPACES
J. L. Denny [1969] 23 p refs Submitted for publication
(Grant NSF GP-8741)
Avail: Issuing Activity

A measure-theoretic extension of Cauchy's functional equation, for real-valued functions defined on measure spaces equipped with a reasonably compatible arcwise connected topology is proved to be equivalent to a theorem which characterizes one-parameter exponential families on such measure spaces in terms of a real-valued sufficient statistic. Author

N70-28560*# California Univ., Berkeley. Electronics Research Lab.
DECISION-MAKING IN A FUZZY ENVIRONMENT
R. E. Bellman and L. A. Zadeh Washington NASA May 1970 63 p refs
(Grant NGL-05-003-016)
(NASA-CR-1594; ERL-69-8) Avail: CFSTI CSCL 12A

By decision making in a fuzzy environment is meant a decision process in which the goals and/or the constraints, but not necessarily the system under control, are fuzzy in nature. This means that the goals and/or the constraints constitute classes of alternatives whose boundaries are not sharply defined. Fuzzy goals and fuzzy constraints can be defined precisely as fuzzy sets in the space of alternatives. A fuzzy decision, then, may be viewed as an intersection of the given goals and constraints. A maximizing decision is defined as the set of points in the space of alternatives at which the membership function of a fuzzy decision attains its maximum value. By using dynamic programming, the determination of a maximizing decision is reduced to the solution of a system of functional equations. A reverse flow technique is described for the solution of a functional equation arising in connection with a decision process in which the termination time is defined implicitly by the condition that the process stops when the system under control enters a specified set of states in its state space. Author

N70-26561# California Univ., Davis.
CELL COMPLEXES, VALUATIONS AND THE EULER RELATION
M. A. Perles (Hebrew Univ.) and G. T. Sallee [1969] 12 p refs
(Grant NSF GP-8188)
Avail: Issuing Activity

Results obtained on functions which were shown to satisfy relations on polytopes similar to the classic Euler relation are extended to illustrate the relationship between valuations and the Euler relation on cell complexes. It is assumed that all events take place in a given finite-dimensional Euclidean space. A polytope is defined as the convex hull of a finite set of points and is referred to as a d-polytope if it has dimension d. Author

N70-26607# California Univ., San Diego.
CENTERED VARIATIONS OF SAMPLE PATHS OF HOMOGENEOUS PROCESSES
Michael Sharpe [1969] 15 p refs
(Grant NSF GP-8770)
Avail: Issuing Activity

Let X = (X sub t, t > or = 0) be a homogeneous stochastic process on the probability space (Omega F, P), i.e. the process X is assumed to have stationary independent increments given by the semigroup (mu sub t). The limits of given sums are considered where f is a certain function on the line and s = (t sub 0 < ... < t sub n) is a partition of /0, t/, over a sequence of partitions S as the mesh of S tends to zero. Convergence of the given sums is considered for the special case f(x) = 'x squared. R.B.

N70-26665# Nebraska Univ., Lincoln. Dept. of Mathematics.
IDEAL THEORY IN PRUEFER RINGS WITH ZERO DIVISORS
Max D. Larsen [1969] 12 p refs
(Grant NSF GP-8932)
Avail: Issuing Activity

Prufer rings with zero divisors which generalize the notion of Prufer domain is defined. It is shown that overrings of Prufer rings are Prufer rings. The relationship between regular ideals of a Prufer ring and those of an overring is shown to be same as in the integral domain case. Also, the regular primary ideal structure of a Prufer ring is studied. All rings considered are commutative and have unity. An element is called regular if it is not a zero divisor and an ideal is called regular if it contains a regular element. An overring of a ring R is a subring of the total quotient ring of R which contains R. The complement of P in R will be denoted by R/P. Author

N70-26711# Massachusetts Univ., Amherst.
SOLUTIONS OF THE n-DIMENSIONAL WAVE EQUATION IN THE EXTERIOR OF THE CHARACTERISTIC CONES, PART 1
Y. W. Chew [1969] 48 p refs Submitted for publication
(Grant NSF GP-8978)
Avail: Issuing Activity

The notion of the hyperboroidal means (HM) is introduced such that it is invariant with respect to the Lorentz and similarity transformations and satisfies the wave equation. In the exterior of the characteristic cones C sub 0, the even and odd solutions which carry smooth initial data can be expressed in terms of HM of the matching boundary data on C sub 0. This is proved by establishing two identities. They are put subsequently, in a weak form applicable to L sub 2-data. By approximation, the result is extended to L sub 2-solutions. Using HM of the boundary values on C sub 0 one has a simple representation of L sub 2-solutions as distributions in the exterior of C sub 0, the uniqueness of the solutions and their domains of dependence are obtained. The space dimension of the wave equation is assumed to be odd. Author

N70-26715# California Univ., Los Angeles.
CYCLOTOMIC SPLITTING FIELDS
Murray M. Schacher [1969] 8 p refs
(Grant NSF GP-13164)
Avail: Issuing Activity

Suppose K is an algebraic number field and D a finite-dimensional central division algebra over k. It is well known that D has infinitely many maximal subfields which are cyclic extensions of k. From the point of view of group representations, however, the natural splitting fields are the cyclotomic ones. Accordingly it has been conjectured that D must have a cyclotomic splitting field which contains a maximal subfield. The objective here is to show that the conjecture is false; a counter-example of exponent p is constructed, one for every prime p. Author

N70-26716# California Univ., Los Angeles. Dept. of Mathematics.
SOLUTIONS OF PURE EQUATIONS IN RATIONAL DIVISION ALGEBRAS
Burton Fein and Murray Schacher [1969] 21 p refs
(Grant NSF GP-13164)
Avail: Issuing Activity

Let a be a rational number and m a positive integer. In this paper it is determined which of the pure equations x (to the m power) + a = 0 have a solution in a finite-dimensional division algebra central over the rational field Q. Necessary and sufficient conditions on m and a are given. Author

N70-26717# Nebraska Univ., Lincoln. Dept. of Mathematics.
PRUEFER RINGS OF FINITE CHARACTER
Max D. Larsen [1969] 12 p refs
(Grant NSF GP-8932)
Avail: Issuing Activity

The valuation theory of Manis was used to define Prufer rings with zero divisors. The notion of a ring of finite character is extended to rings with zero divisors and Prufer rings of finite character are characterized. It is shown that certain Prufer rings of finite character are preserved under large quotient ring formation and that the approximation theorem holds for these rings. Author

N70-26737*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
NOTES ON DECISION, CONTROL, AND DYNAMICAL SYSTEMS
Nov. 1969 50 p refs
(Grant NGR-22-007-068; Contracts N00014-67-A-0298-0006; N00014-67-A-0298-0005; N00014-67-A-0298-0008) (NASA-CR-109653; TR-599) Avail: CFSTI CSCL 12A

CONTENTS:

1. STRUCTURAL PROPERTIES OF THE EQUILIBRIUM SOLUTIONS OF RICCATI EQUATIONS R. W. Brockett (MIT, Cambridge) p 1 9 refs (See N70-26738 13-19)

2. ON THE NONINFERIOR SET FOR THE SYSTEMS WITH VECTOR-VALUED OBJECTIVE FUNCTION K.-c. Chu p 11 22 refs (See N70-26739 13-19)

3. TOWARDS 'GENERALIZED CONTROL THEORY' Y. C. Ho p 23 26 refs (See N70-26740 13-19)

4. ON CONDITIONS OF OPTIMALITY FOR SINGULAR CONTROL PROBLEMS D. H. Jacobson p 27 32 refs (See N70-26741 13-19)

5. NEW CONDITIONS FOR BOUNDEDNESS OF THE SOLUTION OF A MATRIX RICCATI DIFFERENTIAL EQUATION D. H. Jacobson p 33 39 refs (See N70-26742 13-19)

6. CONDITIONS FOR EXISTENCE OF SYMMETRIC SOLUTIONS OF THE MATRIX EQUATION C + B SUP T P = 0 D. H. Jacobson p 41 45 refs (See N70-26743 13-19)

N70-26738*# Massachusetts Inst. of Tech., Cambridge.
STRUCTURAL PROPERTIES OF THE EQUILIBRIUM SOLUTIONS OF RICCATI EQUATIONS
Roger W. Brockett *In* Harvard Univ. Notes on Decision, Control, and Dynamical Systems Nov. 1969 p 1-9 refs (See N70-26737 13-19)
(Grants NGR-22-009-124; NSF GK-2645) Avail: CFSTI CSCL 12A
The behavior of certain solutions of the quadratic matrix equation A'K + KA - KBB'K = -rhoC'C is investigated as a function of a real variable rho. An a priori bound on the solutions is found by using variational interpretation of an associated Riccati equation, transform techniques, and an elementary version of Parseval's formula. Certain important theorems on the absence of conjugate points are proved without using any results on spectral factorization of rational matrices. R.B.

N70-26739*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
ON THE NONINFERIOR SET FOR THE SYSTEMS WITH VECTOR-VALUED OBJECTIVE FUNCTION
K'Ai-ching Chu *In its* Notes on Decision, Control, and Dynamical Systems Nov. 1969 p 11-22 refs (See N70-26737 13-19)
Avail: CFSTI CSCL 12A
The necessary and sufficient conditions of the locally noninferior set for the static optimization problem with a vector-valued objective function have been derived. Equality and inequality constraints in the variable space have been discussed to give a more complete formulation. All of these have been done by using the properties of the linear dual inequality systems. The example presented gives a clue to solve general problems. Author

N70-26740*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
TOWARD 'GENERALIZED CONTROL THEORY'
Y. C. Ho *In its* Notes on Decision, Control, and Dynamical Systems Nov. 1969 p 23-26 refs (See N70-26737 13-19)
Avail: CFSTI CSCL 12A
A framework is established within which optimization problems in control theory can be resolved. The problem is considered in terms of the criterion function, the controller, and the information available to the controller. For traditional control theory, all the ingredients are singular in the sense that there is only one criterion, one central controller coordinating all control actions, and one information set available to the controller. Categories are established for cases where all the ingredients are not singular, but where they vary with different situations or problems. R.B.

N70-26741*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
ON CONDITIONS OF OPTIMALITY FOR SINGULAR CONTROL PROBLEMS
D. H. Jacobson *In its* Notes on Decision, Control, and Dynamical Systems Nov. 1969 p 27-32 refs (See N70-26737 13-19)
Avail: CFSTI CSCL 12A
Satisfaction of the generalized Legendre Clebsch condition is known to be a necessary condition of optimality in singular control problems. Recently, an additional, necessary condition of optimality was discovered. It is demonstrated by means of an example that together these two necessary conditions are, in general, insufficient for optimality in singular control problems. Author

N70-26742*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
NEW CONDITIONS FOR BOUNDEDNESS OF THE SOLUTION OF A MATRIX RICCATI DIFFERENTIAL EQUATION
D. H. Jacobson *In its* Notes on Decision, Control, and Dynamical Systems Nov. 1969 p 33-39 refs (See N70-26737 13-19)
Avail: CFSTI CSCL 12A
Sufficient conditions are given for a matrix Riccati differential equation to have a bounded solution; these conditions are less stringent than those known heretofore. The conditions are in the form of linear, algebraic, and differential inequalities. Author

N70-26743*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
CONDITIONS FOR EXISTENCE OF SYMMETRIC SOLUTIONS OF THE MATRIX EQUATION C + B SUP T P = 0
D. H. Jacobson *In its* Notes on Decision, Control, and Dynamical Systems Nov. 1969 p 41-45 refs (See N70-26737 13-19)
Avail: CFSTI CSCL 12A
Conditions are presented which guarantee the existence of real n x n symmetric matrices P which solve a given matrix equation in terms of C and B, in which C is an m x n matrix and B is an n x m matrix, m = or = n. The elements of the matrices C and B are assumed to be real and bounded. Author

N70-26752# Joint Publications Research Service, Washington, D.C.
CYBERNETICS AND REGULATION THEORY
19 Feb. 1970 28 p refs Transl. into ENGLISH from Dokl. Akad. Nauk (Moscow), v. 189, no. 2, 4, and 5, 1969 p 265-268, 748-755, 963-966
(JPRS-49888) Avail: CFSTI

CONTENTS:
1. THE PROBLEM OF LARGE SYSTEM EFFECTIVENESS G. K. Stolyarov p 1-7 refs (See N70-26753 13-08)
2. IMPOSSIBILITY OF ELIMINATING COMPLETE SORTING WHEN CALCULATING FUNCTIONS WITH RESPECT TO THEIR GRAPHS M. I. Dekhtyar p 8-13 refs (See N70-26754 13-08)
3. ESTIMATING THE COMPLEXITY OF REALIZING MONOTONIC SYMMETRICAL FUNCTIONS L. S. Khasin p 14-20 refs (See N70-26755 13-19)
4. APPLYING THE PRINCIPLE OF THE MAXIMUM IN CALCULATING OPTIMAL CONTROLS FOR DISCRETE SYSTEMS R. Gabasov et al p 21-26 refs (See N70-26756 13-19)

N70-26755# Joint Publications Research Service, Washington, D.C.
ESTIMATING THE COMPLEXITY OF REALIZING MONOTONIC SYMMETRICAL FUNCTIONS
L. S. Khasin *In its* Cybernetics and Regulation Theory 19 Feb. 1970 p 14-20 refs (See N70-26752 13-19)
Avail: CFSTI
A function f sub p(x sub 1, ..., x sub n) defined by a given formula is called a monotonic symmetrical function of the algebra of logic with the threshold p. Upper bounds are found for L sub p (n), the least number of letters sufficient for realization by the given function. Author

N70-26756# Joint Publications Research Service, Washington, D.C.
APPLYING THE PRINCIPLE OF THE MAXIMUM IN CALCULATING OPTIMAL CONTROLS FOR DISCRETE SYSTEMS
R. Gabasov et al *In its* Cybernetics and Regulation Theory 19 Feb. 1970 p 21-26 refs (See N70-26752 13-19)
Avail: CFSTI
A method is proposed for using the principle of the maximum based on replacing the initial problem with auxiliary problems and the solution of the latter by the principle of the maximum with subsequent construction of an approximate solution of the initial problem. The given concept is in accord with the concepts of sliding conditions. Author

N70-26759# California Univ., Los Angeles.
CONGRUENCE RELATIONS IN DIRECT PRODUCTS
Grant A. Fraser and Alfred Horn [1969] 11 p ref Submitted for publication
(Grant NSF GP-9044)
Avail: Issuing Activity

Conditions are studied under which every congruence relation theta in a direct product A × B of algebras is of the form theta sub 1 × theta sub 2, where theta sub 1 and theta sub 2 are congruence relations in A and B respectively. It is shown that for any equational class K, every such congruence relation in every A × B in K has this property if and only if K satisfies certain identities. Author

N70-26771# Iowa Univ., Iowa City.
MAPPINGS OF GENERALIZED CONTRACTIVE TYPE
W. A. Kirk [1969] 10 p refs Submitted for publication
(Grant NSF GP-8367)
Avail: Issuing Activity

A class of contractive mappings which seems to arise naturally in the study of Frechet differentiable functions is discussed. Author

N70-26772# Iowa Univ., Iowa City.
ON SUCCESSIVE APPROXIMATIONS FOR NONEXPANSIVE MAPPINGS IN BANACH SPACES
W. A. Kirk [1969] 9 p refs Submitted for publication
(Grant NSF GP-8367)
Avail: Issuing Activity

Let X be a Banach space and K a convex subset of X. A mapping T of K into K is called a nonexpansive mapping if certain conditions are met. In general, it is not the case for nonexpansive mappings T that the sequences of Picard iterates converge to fixed points of T, and thus when such fixed points exist other approximation techniques are needed. General mappings that yield similar convergence theorems are presented. Author

N70-26773# Iowa Univ., Iowa City.
REMARKS ON PSEUDO-CONTRACTIVE MAPPINGS
W. A. Kirk [1969] 7 p refs Submitted for publication
(Grant NSF GP-8367)
Avail: Issuing Activity

Let X be a uniformly convex Banach space, B a closed ball in X, G an open set containing B. Let U be a pseudo-contractive mapping of G into X such that U maps the boundary of B into B. Suppose also that U is demicontinuous and that either (a) U is uniformly continuous in the strong topology on bounded subsets of X, or (b) X is uniformly convex. Then U has a fixed point in B. An elementary geometric proof is given of a theorem which is a slight variation of the given (a) version. The assumption of demicontinuity of U and condition (a) is strengthened by simply requiring U to be Lipschitzian, but at the same time it is not necessary to assume that U is defined on an open set containing B. Author

N70-26783# Stanford Univ., Calif. Dept. of Statistics.
KOLMOGOROV-TYPE TESTS FOR EXPONENTIALITY WHEN THE SCALE PARAMETER IS UNKNOWN Technical Report
M. A. Stevens 15 Jan. 1970 21 p refs
(Contract NONR-255(52))
(AD-701308; TR-154) Avail: CFSTI CSCL 12/1

The paper shows how four statistics (Kolmogorov-Smirnov, Cramer-von Mises, and the Kuiper and Watson extensions) may be used to test whether a given sample comes from the exponential distribution with unknown parameter. Simple modifications of the basic definitions make it possible to use each statistic with only one line of percentage points: in turn, these may be reduced to chi-square points. The tests are more powerful than the usual Pearson chi-square test, and are very well adapted for use with a computer. Author (TAB)

N70-26785# California Univ., Berkeley. Dept. of Electrical Engineering.
ALMOST SURE BOUNDEDNESS OF RANDOMLY SAMPLED SYSTEMS
R. G. Agniel and E. I. Jury Feb. 1970 21 p refs
(Grant AF-AFOSR-1463-68)
(AD-701779; AFOSR-70-0517TR) Avail: CFSTI CSCL 12/1

The paper discusses the almost sure boundedness of linear and nonlinear randomly sampled systems. It is shown that if an autonomous linear randomly sampled system exhibits almost sure asymptotic stability, then the system is almost surely bounded input-bounded output. Moreover, for a bounded input, the second moment of the out-put remains bounded and this bound is easily computable. It is also found that linear or nonlinear systems which are almost surely asymptotically stable for a null input, remain almost surely bounded when the input consists of an uncorrelated noise with finite variance. Author (TAB)

N70-26792# Florida State Univ., Tallahassee.
ON ARC AND BALL PAIRS AND QUASI-TRANSLATIONS OF THE THREE-SPHERE
Carl D. Sikkema and Shin'ichi Kinoshita [1969] 24 p refs Submitted for publication
(Grant NSF GP-8417) Avail: Issuing Activity

Let a be an arc in a 3-ball B such that only the end point P(a) (but not the initial point) of a is on the boundary of B and a is locally tame in B except at the end point. The arc and ball pair is denoted by (a, B). A binary operation is introduced for two arc and ball pairs, called a composition, and a quasi-translation is constructed for each arc and ball pair (a, B). The quasi-translation is proved to be topologically equivalent to a standard translation if and only if (a, B) is the trivial pair (a, B). It is also proved that the composition is noncommutative in general and that there are uncountably many mutually topologically inequivalent quasi-translations of S cubed. Author

N70-26793# California Univ., Los Angeles.
EMBEDDING FINITE GROUPS IN RATIONAL DIVISION ALGEBRAS
Burton Fein and Murray Schacher [1969] 29 p refs
(Grant NSF GP-13164)
Avail: Issuing Activity

Using results which show that the minimal possible non-cyclic odd order group of a division ring is one of order 63, the conjecture that the finite odd order subgroups of the multiplicative group of a division ring are cyclic is verified for subgroups of finite-dimensional division algebras central over the field of rational numbers Q. Assuming K is a field, a K-division ring is defined as a finite-dimensional central division algebra over K. If a finite group G is contained in the multiplicative group D^* of a k-division ring, it is said that G is K-adequate. A complete list of Q-adequate groups is obtained, where Q denotes the field of rational numbers. R.B.

N70-26822# North Carolina Univ., Chapel Hill. Dept. of Statistics.
MULTITYPE BRANCHING PROCESSES IN RANDOM ENVIRONMENTS
Edward W. Weissner Feb. 1970 74 p refs *Its* Inst. of Statistics Mimeo Ser. No. 684
(Contract N00014-67-A-0321-0002)
(AD-700941) Avail: CFSTI CSCL 12/1

Consider the k-type Galton-Watson process. The work removes the restrictive assumption that particles of the same type always

divide in accordance with the same probability generating function (p.g.f.). Instead, it is assumed that at each unit of time, Nature chooses a k-vector of p.g.f.s from a class of k-vectors of p.g.f.s., independently of the population, past and present, and the previously selected k-vectors, which is then assigned to the present population. Each particle of the present population then splits or disintegrates, independently of the others, in accordance with the p.g.f. assigned to its classification. This process is called a multitype branching process in a random environment (MBPRE). The work gives some necessary and some sufficient conditions for almost certain extinction of the MBPRE when there are at least two particle classifications. To obtain these results, Jensens inequality, the dual process suggested by Smith and Wilkinson, and some results on products of random matrices are used. Since the theorems require the user to evaluate limits of sequences of products of random arrays, some corollaries are included which involve simpler, albeit less general, conditions. Author (TAB)

N70-26829# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
SOME ASYMPTOTIC SIMULTANEOUS TESTS FOR MULTIVARIATE MOVING AVERAGE PROCESSES Final Report
P. R. Krishnaiah and P. K. Sen Oct. 1969 43 p refs
(AD-700771; ARL-69-0179) Avail: CFSTI CSCL 12/1

The present investigation is concerned with the study of a class of asymptotic simultaneous tests in m-dependent moving average schemes. These procedures involve the use of the sample means, sign statistics and some other well-known rank statistics. The results are the multivariate multi-sample generalizations of Sen (1965) along the lines of simultaneous test procedures of Krishnaiah (1969). Author (TAB)

N70-26830# Aero Space Research Labs., Wright-Patterson AFB, Ohio.
SIMULTANEOUS TESTS FOR EQUALITY OF LATENT ROOTS AGAINST CERTAIN ALTERNATIVES, 2 Final Report
P. R. Krishnaiah and V. B. Waikar Oct. 1969 28 p refs
(AD-700770; ARL-69-0178) Avail: CFSTI CSCL 12/1

The authors proposed a procedure for testing for the equality of latent roots of a matrix, when the associated random matrix has certain distribution, against the alternative that at least two of the roots are unequal. The random matrices considered are (1) Wishart matrix; (2) (S sub 1)(S sub 2)superscript -1; (3) matrix connected with MANOVA; and, (4) matrix associated with canonical correlations; here S sub 1 and S sub 2 are independently distributed central Wishart matrices. Author (TAB)

N70-26862# California Univ., Los Angeles. Dept. of Mathematics.
ON THE REPRESENTATION OF -1 AS A SUM OF TWO SQUARES IN AN ALGEBRAIC NUMBER FIELD
Burton Fein and Basil Gordon [1969] 10 p refs Submitted for publication
(Grant NSF GP-13164)
Avail: Issuing Activity

Theorems are derived to find necessary and sufficient conditions in order for minus 1 to be the sum of two squares in any algebraic number field K. Equations are derived to determine when the condition (*) holds in K: (*) minus 1 can be represented as a sum of two squares in K. E.M.C.

N70-26881# Texas Univ., Austin. Computation Center.
A MULTIPLICITY-INDEPENDENT, GLOBAL ITERATION FOR MEROMORPHIC FUNCTIONS Interim Technical Report
Alvis E. Mc Donald Nov. 1969 117 p refs
(Grants DA-ARO(D)-31-124-G721; NSF GP-5253)
(AD-701128; AROD-3772-53-M; ITR-24) Avail: CFSTI CSCL 12/1

A result of E. Schroder for the numerical solution of polynomial equations is generalized to the class of equations meromorphic within a simple closed contour C in the complex plane. The method uses numerical contour integration to compute roots and/or poles of an equation. It supplies error bounds and root multiplicities by products of the iteration. Author (TAB)

N70-26883# University of Southern Calif., Los Angeles. Electronics Sciences Lab.
ON THE SOLUTIONS OF CERTAIN INTEGRAL-LIKE OPERATOR EQUATIONS. EXISTENCE, UNIQUENESS AND DEPENDENCE THEOREMS
Lucien W. Neustadt Feb. 1970 58 p refs
(Grants AF-AFOSR-1029-67; AF-AFOSR-1622-69)
(AD-701068; AFOSR-70-0365TR) Avail: CFSTI CSCL 12/1

Equations of the form x = Tx are studied, where x is a continuous, finite-dimensional vector-valued function defined on a compact interval, and T is an operator from a set in the linear space of all such functions into this space. Under suitable assumptions - which essentially assert that the operator T is, in some sense, integral-like--local existence, continuation and uniqueness theorems are proved, which are very analogous to those for ordinary differential equations. Further theorems are proved covering the dependence of x on T which generalize well-known continuous and differentiable dependence theorems for ordinary differential equations. The general results are applied to ordinary differential equations, Volterra integral equations, and functional differential equations. Author (TAB)

N70-26887# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
TABLES OF TOROIDAL HARMONICS, 2: ORDERS 5-10, ALL SIGNIFICANT DEGREES Final Report
Henry E. Fettis and James C. Caslin Dec. 1969 188 p refs
(AD-701729; ARL-69-0209) Avail: CFSTI CSCL 12/1

The report, which is a continuation of AD-687 108 contains eleven-figure tables of the Legendre function Q(sub n-1/2) superscript m (s) for m = 5, 6, 7, 8, 9, 10 and all values of n for which the functions are of significant magnitude compared with those of zero degree. As before, the tables are in two parts: the first with argument s and the second with argument cosh (eta). Author (TAB)

N70-26889# Battelle Memorial Inst., Columbus, Ohio.
A SURVEY OF OPTIMAL CONTROL OF DISTRIBUTED-PARAMETER SYSTEMS Final Report, 1 Jun.–1 Oct. 1969
Alfred C. Robinson Nov. 1969 48 p refs
(Contract F33615-69-C-1761)
(AD-701732; ARL-69-0177) Avail: CFSTI CSCL 12/1

The report is a survey of theoretical and computational methods in the field of optimal control of distributed parameter systems. This includes systems described by integral equations and partial differential equations. The various studies which have been done are grouped according to the method employed. A number of applications and potential applications of these methods are discussed, and certain deficiencies in the current state of knowledge are noted. Difficulties and opportunities in practical applications are discussed, and suggestions are offered for directions of research to render the results more readily usable. A list of references is included numbering more than 250 items: papers, report, and books. Author (TAB)

N70-26891# International Business Machines Corp., Yorktown Heights, N.Y. Watson Research Center.
COMPUTATIONAL COMPLEXITY Final Report
Shmuel Winograd 14 Nov. 1969 7 p refs

(Contract N00014-69-C-0023)
(AD-699955) Avail: CFSTI CSCL 12/1

Progress is reported in the following three areas: Arithmetic complexity of functions; Compiler optimization; and Chaotic relaxation methods for solving sets of linear equations. TAB

N70-26906# Stanford Univ., Calif. Operations Research House.
ON BOUNDS FOR COMPLEMENTARY TREES IN A GRAPH
Ilan Adler Dec. 1969 13 p ref
(Contracts N00014-67-A-0112-0011; AT(04-3)-326; N00014-67-A-0112-0016; DAHC04-67-C-0028; Grant NSF GP-6431)
(AD-701309; TR-69-13) Avail: CFSTI CSCL 12/2

It was shown elsewhere by Dantzig that if there exits one complementary tree in the undirected network G(G epsilon eta(n)) then there exists at least two. The proof there is by means of an algorithm which finds a different complementary tree from a given one. It is shown in this paper that using an extended form of Dantzigs algorithm can lead to a stronger result: if there exists one complementary tree in G(G epsilon eta(n)) then there exists at least four. Also some examples are provided to establish an upper bound on the smallest number of complementary trees in a network G(G epsilon eta(n)) which has at least one complementary tree. TAB

N70-26914 Tulane Univ., New Orleans, La.
A STUDY OF SYSTEMS IDENTIFICATION
William Frank Snyder (Ph.D. Thesis) 1969 152 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-20505

Two methodologies were formulated and tested for use in system identification. One methodology was formulated in the frequency domain and the other in the time domain. Both identify candidate systems represented or approximated by linear time invariant differential equations. That theoretical advances in control theory, nonlinear regression, and state space techniques could be used to formulate powerful algorithms for use in system identification was demonstrated. The presented algorithm was formulated to yield a statistically best fit between the model and system information in the time domain utilizing all frequency response data, i.e., both magnitude and phase data. Through a state space representation of a general differential equation, a general model cast in a transformed time domain was formulated which enabled an analytic solution to the general state space equations. Dissert. Abstr.

N70-26944# California Univ., Davis.
HAMILTONIAN CIRCUITS ON 3-POLYTOPES
David Barnette and E. Jucovic [1969] 7 p refs Prepared in cooperation with Kosice Coll. of Technol., Czechoslovakia
(Grant NSF GP-8470)
Avail: Issuing Activity

Theorems are derived to give the minimum number of vertices and edges or facets of a 3-polytope and a simplicial 3-polytope whose graph does not admit Hamiltonian circuits. A Hamiltonian path (circuit) of a graph G is defined as a simple path which involves all vertices of G; a d-polytope is called simplicial provided all its facets are (d minus 1)-simplices). Proofs are offered to show: (1) The minimum number of vertices and edges or facets of a 3-polytope, whose graph does not admit Hamiltonian circuits, is 11 and 18 or 9, respectively. (2) The minimum number of vertices and edges or facets of a simplicial 3-polytope, whose graph does not admit Hamiltonian circuits, is 11 and 27 or 18, respectively. E.M.C.

N70-26945# Florida State Univ., Tallahassee.
ON HIGHER-DIMENSIONAL FIBERED KNOTS
J. J. Andrews and D. W. Sumners [1969] 30 p refs
(Grant NSF GP-8417)
Avail: Issuing Activity

Fibering manifolds over a circle, and the obstructions involved are considered. A general situation of a fiber bundle is presented, also the particular case of fibered k-spun knots. An algebraic result about extending module presentations is developed. The results are applied to calculate the homotopy structure of simple fibered knots such as the 5-twist-spun trefoil and the k-spun trefoil. E.M.C.

N70-26949# Wisconsin Univ., Madison. Dept. of Statistics.
ON THE NUMERICAL SOLUTION OF FREDHOLM INTEGRAL EQUATIONS OF THE FIRST KIND Technical Report
Grace Wahba Oct. 1969 63 p refs
(Contract DA-31-124-ARO(D)-462, Grant AF-AFOSR-69-1803)
(AD-701880; UWIS-DS-69-217) Avail: CFSTI CSCL 12/1

The report is concerned with the numerical solution of a Fredholm integral equation of the first kind. Two methods in the literature seem to have resulted in satisfactory numerical examples. The first method is called the method of regularization of Tihonov and was studied experimentally by Tihonov and Glasko. The second method was discussed by Strand and Westwater and is called statistical estimation of the solution. Both of these methods can be embedded in the general theory of the approximation of continuous linear functionals in a reproducing kernel Hilbert space. The overall purpose of this note is to demonstrate this statement in some considerable practical detail. TAB

N70-27023# Naval Research Lab., Washington, D.C.
A NAVY STATISTICAL DECISION PROBLEM INVOLVING RADAR-BEACON DATA
Walton B. Bishop Dec. 1969 19 p
(AD-701320; NRL-MR-2084) Avail: CFSTI CSCL 17/9

A problem often encountered in Navy systems that make use of radar or radar-beacon data is described in mathematical terms. This problem must be solved before certain electronic equipment can be designed to make optimum use of available information. The problem involves finding an optimum statistical decision function that can use distribution-free methods. There are a number of other obvious applications that can be made of solutions to this problem. Some of these applications are described along with current approaches to a solution that are being pursued. Author (TAB)

N70-27026*# Bellcomm, Inc., Washington, D.C.
EXPLICIT INVERSE FOURIER TRANSFORMATION OF A RATIONAL FUNCTION AND A NEW THEOREM
S. Y. Lee 2 Feb. 1970 20 p refs
(Contract NASw-417)
(NASA-CR-109781; TM-70-1033-2) Avail: CFSTI CSCL 12A

Analyses in areas such as communication, network, and control theory are often performed in the requency domain. Many solutions are not complete until the inverse Fourier transformation of a rational algebraic fraction has been successfully carried out. With the results derived, the inverse Fourier transform h(t) of any general rational algebraic fraction can be obtained directly from a table after partial fraction expansion of H(j omega) has been performed without any further calculation. A theorem for the evaluation of the inverse Fourier transforms of the terms consisting of poles on the j omega axis was developed. With the addition of this theorem, the inverse Fourier transform of any rational algebraic fraction can be evaluated directly from its inverse Laplace transform. A computer program was developed for obtaining the inverse Fourier transformertion of a general rational algebraic fraction where the output of this method is a closed form solution in time. Numerical examples are provided to show the usage of this computer program. Author

N70-27037# Syracuse Univ., N.Y.
STUDY OF PROJECTILE PLANES. STUDIES IN ALGEBRA Final Report, 1 Oct. 1962 – 27 Oct. 1969
Erwin Kleinfeld Jan. 1970 7 p refs Prepared in cooperation with Iowa Univ.
(Contracts DA-31-124-ARO(D)-36; DAHC04-69-C-0018)
(AD-701125; AROD-3901-18-M; AROD-8189-2-M) Avail: CFSTI CSCL 12/1

Papers generated under an investigation of combinatories, matrix theory, ring theory, and foundations of projective planes and their applications are listed. Author (TAB)

N70-27041# Case Western Reserve Univ., Cleveland, Ohio. Systems Research Center.
OPTIMIZATION OF NONLINEAR INTERACTING SYSTEMS Final Report, 9 Feb. 1965 – 31 Aug. 1969
L. Lasdon and C. Brosilow 1970 67 p refs
(Contracts DA-ARO(D)-31-124-G647; DA-ARO(D)-31-124-G975)
(AD-701126; AROD-5510-9-M) Avail: CFSTI CSCL 12/1

The research has been concerned with the optimization of large systems having special structure. The structures studied are (1) separable systems; that is, systems composed of coupled subsystems, (2) countercurrent systems, (3) systems evolving according to a set of ordinary differential equations, and (4) stochastics systems evolving according to a Markov process. In studying (1) the problem was decomposed into a set of coordinated subproblems, while in (2) the subsystems were aggregated and simplified. Under (3), a number of efficient finite dimensional optimization methods have been extended to this infinite dimensional case. In (4), an approach to optimal design was constructed which does not require explicit knowledge of the steady state behavior of the system. Author (TAB)

N70-27088*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
RESEARCH IN PRECISION INTEGRATION METHODS Final Report, 1 Apr. 1969 – 31 Mar. 1970
L. J. Gallaher and I. E. Perlin 31 Mar. 1970 156 p refs
(Grant NGR-11-002-101; Proj. A-1167)
(NASA-CR-86371) Avail: CFSTI CSCL 12A

The results of comparisons and computer tests of several methods for numerically integrating systems of coupled nonlinear differential equations (initial value problems) are given. The methods tested are: Shanks' formulas for the method of Runge and Kutta, The Adams, Bashforth, and Moulton method, Butcher's formulas for the method of Stetter and Gragg, and Cowell's method. Each of these methods was programmed as a general purpose subroutine in double precision FORTRAN V for the UNIVAC 1108. The test problem on which results are given here is that of a particle in an inverse square attractive force field with an elliptic orbit of eccentricity 0.8. Plots are given of error versus time and versus number of function evaluations for the various methods and orders. The results show that all of the methods perform well but the higher orders of each method are significantly faster at the higher accuracies. At corresponding orders the Butcher formulas appear to be superior. Author

N70-27141*# Bellcomm, Inc., Washington, D.C.
TRANSFORMATION OF A POTENTIAL FUNCTION UNDER COORDINATE ROTATIONS
S. L. Levie, Jr. 18 Feb. 1970 28 p refs
(Contract NASw-417)
(NASA-CR-109771; TR-70-310-1) Avail: CFSTI CSCL 12A

A potential function is a solution of Laplace's equation. The operator is form-invariant under rotations of the coordinate system, so solutions of Laplace's equation in two coordinate systems connected by a rotation satisfy the same differential equation. Hence, they have the same series expansions, but with different values of the expansion coefficients. This paper derives the detailed connection between the new and old expansion coefficients, and it provides an example to illustrate the concepts and the use of the equations involved. Author

N70-27160*# Bellcomm, Inc., Washington, D.C.
PAP: PARAMETRIC ANALYSIS PROGRAM
P. F. Long 21 Jan. 1970 93 p refs
(Contract NASw-417)
(NASA-CR-109832; TM-70-1032-1) Avail: CFSTI CSCL 12A

PAP provides a systematic approach to Parametric Analysis of systems whose characteristics (dependent variables) are continuous functions of the system parameters (independent variables). It is designed to explore the parameter space of a system using as few system evaluations as possible. The approach taken by PAP is to apply n-2 (n is the number of system parameters) constraints to the parameter space for fixed values of the remaining two parameters. Determine solutions to this nonlinear constraint problem and map the solutions found to the points of a grid determined by the domains of the two parameters previously fixed. This gives rise to a number of functions of two variables defined at discrete points which represent the behavior of the constrained system. PAP provides an interpolation scheme to generate contours of these functions and a flexible plotting capability so that they may be displayed in various combinations. Author

N70-27202# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
A CHARACTERIZATION BASED ON THE ABSOLUTE DIFFERENCE OF TWO INDEPENDENT AND IDENTICALLY DISTRIBUTED RANDOM VARIABLES
Prem S. Puri and Herman Rubin Jan. 1970 19 p refs *Its* Mimeograph Ser. No. 218
(Contract N00014-67-A-0226-0008; Grant PHS-GM-10525)
(AD-700291) Avail: CFSTI CSCL 12/1

Let X be a nonnegative random variable with X sub 1 and X sub 2 as its two independent copies. The problem considered here is to characterize all the nonnegative distributions with the property that the distribution of the absolute difference /(X sub 1)-(X sub 2)/ is the same as that of X. It is shown that in general such a distribution has to be either purely discrete, or absolute continuous or singular and that it cannot be their mixture. Author (TAB)

N70-27204# Weibull (Waloddi), Lausanne (Switzerland).
HIGH-FIDELITY APPROXIMATIONS TO MEDIAN PERCENTAGE POINTS OF ORDER STATISTICS Summary Report, 1 Aug. – 31 Oct. 1969
Waloddi Weibull and Goeran W. Weibull Nov. 1969 23 p refs *Its* Scientific-1
(Contract F61052-69-C-0029)
(AD-700768; AFML-TR-69-317) Avail: CFSTI CSCL 12/1

The exact median percentage points of order statistics have been computed by use of methods indicated in the text, and a table for N = 11(1)25(25)100(50)200 with six significant figures is presented. A general approximation formula, involving three parameters, has been proposed and its capacity has been examined. Parameters of the two-parametric version have been determined and introduced into the formula, which yields a very high accuracy. Author (TAB)

N70-27224# California Inst. of Tech., Pasadena.
THE MULTIPLIERS OF THE SIMPLE GROUPS OF ORDER 604, 800 AND 50, 232, 960
John Wales David Mc Kay 1969 18 p refs
(Contract N00014-67-A-0094-0010; Grant NSF GP-1326)
(AD-702480) Avail: CFSTI CSCL 12/1

The groups were first characterized by Janko in terms of the centralizer of a central involution. The existence and uniqueness

of these groups is discussed for J sub 2 and for J sub 3. Because the centralizers of a central involution are the same, it is natural to consider both groups together in determining the two parts of the multipliers. The main results indicate that the multiplier of J sub 2 has order 2 and that J sub 3 has order 3. A consequence is that J sub 3 has a projective representation of degree 18. Author

N70-27230# Rice Univ., Houston, Tex. Dept. of Mathematical Sciences.
ADJACENCY ON CONVEX POLYHEDRA
Katta G. Murty 1970 29 p refs
(Grants DA-ARO(D)-31-124-0767; DA-ARO(D)-31-124-70-G42)
(AD-701090; TR-76-031-1; TR-69-22; AROD-8802-1-M) Avail: CFSTI CSCL 12/2

Some results on the adjacency properties of extreme points of a convex polyhedron are discussed. Author (TAB)

N70-27239 National Lending Library for Science and Technology, Boston Spa (England).
RINGS POSSESSING MINIMAL TWO-SIDED IDEALS [KOLTSA OBLADAYUSHIE MINIMALNYMI DVUSTORONNIMI IDEALAMI]
V. A. Anderunakievich Mar. 1970 9 p refs Transl. into ENGLISH from Kokl. Akad. Nauk SSSR (Moscow), v. 100, no. 3, 1955 p 405–408
(NLL-RT-5416) Avail: Natl. Lending Library, Boston Spa, Engl.: 10s or 1 NLL photocopy coupons

Associated rings are described which contain minimal ideals. The basic result is the theorem that the ring is representable in the form of a direct sum of all the minimal ideals with a unity of the ring and the annihilator of the direct sum, if and only if every principal ideal of the ring does not contain more than a finite number of minimal ideals with a unity. Author

N70-27241# Naval Research Lab., Washington, D.C. Nuclear Physics Div.
A DOUBLE PRECISION FORTRAN FUNCTION TO FIND CLEBSCH-GORDON COEFFICIENTS AND 3-J AND SYMBOLS USED IN THE OF ANGULAR MOMENTA Final Report
James B. Langworthy Aug. 1969 20 p refs
(AD-700654; NRL-MR-2070) Avail: CFSTI CSCL 12/1

A one package, double precision, FORTRAN function which calculates Clebsch-Gordan coefficients and 3-J and 6-J symbols useful in quantum theory of angular momenta is given. Use of integer argument, double the usual angular momentum value, allows the routine to present a true or conventional value for every set of input arguments or to exit if upper limits are exceeded. Author (TAB)

N70-27276# California Univ., Davis.
PROJECTIONS OF 3-POLYTOPES
David W. Barnette [1969] 8 p refs
(Grant NSF GP-8470)
Avail: Issuing Activity

The combinatorial structure of a convex 3-dimensional polytope is investigated with respect to its shape. If P is a 3-polytope, a regular projection of P is regarded as an orthogonal projection of P onto a plane in a direction not parallel to any face of P. A proof is given for the theorem: If S is a simple circuit in the graph of a 3-polytope P, then there is a 3-polytope P' of the same combinatorial type as P, such that the corresponding circuit in P' is the inverse image of the boundary of some regular projection of P'. Author

N70-27340*# Computer Usage Co., Inc., Bethesda, Md.
A COMPUTER PROGRAM FOR POWER SPECTRAL ANALYSIS OF UNEQUALLY SPACED POINTS. VOLUME 1: USER'S MANUAL
Matthew Lybanon 30 Jan. 1970 63 p refs Prepared for Bellcomm, Inc.
(Contract NASw-417)
(NASA-CR-109831; PDN-70-501-Vol-1) Avail: CFSTI CSCL 12A

A power spectral density computer program with some unique capabilities is described. The special features include: (1) The spectrum of unequally spaced data may be calculated. (2) The spectrum can be evaluated at any frequencies. (3) Estimates of the parameters of dominant spectral terms can be improved. (4) Prewhitening can be done with no prior knowledge of the characteristics of the signal. The mathematical basis of the conventional computer Fourier analysis technique is discussed, with special attention to the approximations involved. The problem of spectral analysis is then considered as a least-squares regression problem. Formulas are developed for continuous and discrete equally spaced data. The interpretation of the power spectral estimates is explored, and the possibility of evaluating the spectrum at any set of frequencies is discussed. General formulas for unequally spaced points are then derived. The computer program implementing the theory is described and includes a discussion of the program and its use, a description of the input cards and of the form of the output, and instructions for execution. Appendices include a flowchart and a sample run. Author

N70-27341*# Computer Usage Co., Inc., Bethesda, Md.
A COMPUTER PROGRAM FOR POWER SPECTRAL ANALYSIS OF UNEQUALLY SPACED POINTS. VOLUME 2: MAINTENANCE MANUAL
Matthew Lybanon 30 Jan. 1970 40 p Prepared for Bellcomm, Inc.
(Contract NASw-417)
(NASA-CR-109830; PDN-70-502-Vol-2) Avail: CFSTI CSCL 12A

The computer program whose mathematical method is derived in N70-27340 is discussed in some detail. The discussion and tables cover the contents of COMMON blocks, major calculations, subroutine argument lists, and program logic. A listing of the program system and an overall logic flowchart are included. Author

N70-27373# Western Michigan Univ., Kalamazoo. Dept. of Mathematics.
ASYMPTOTIC SOLUTIONS OF A SYSTEM OF DIFFERENTIAL EQUATIONS AT A TURNING POINT
Po-Fang Hsieh Oct. 1969 21 p refs /*ts* Math. Rept. 13
Avail: CFSTI

A block diagonalization theorem for a system of differential equation with asymptotic expansions in terms of preserving analyticity is restated. Asymptotic solutions with analyticity properties having distinct eigenvalues are obtained. Author

N70-27401# Royal Aircraft Establishment, Farnborough (England).
VECTOR DESCRIPTION OF ROTATIONS
A. J. Sarnecki Aug. 1969 31 p refs
(RAE-TR-69164) Copyright. Avail: CFSTI

The four-parameter method of describing rotations has been presented in purely vector terms, the four parameters being the three components of a vector along the axis of rotation and the 'co-magnitude' of the vector needed to resolve an ambiguity. The rate of change of the rotation vector is simply related to the angular velocity by a formula which requires remarkably little computation of coefficients in the differential equations of the motion. Author (ESRO)

N70-27406# Boston Coll., Chestnut Hill, Mass. Space Data Analysis Lab.
NUMERICAL AND DATA ANALYSIS SOLUTIONS OF SCIENTIFIC PROBLEMS Final Report, 1 Jan. –31 Dec. 1969
Richard W. Doherty, Joseph F. Russell, Neil Grossbard, Rose M. Ring, and Paul E. Meehan 31 Jan. 1970 71 p Sponsored in

part by DASA
(Contract F19628-69-C-0115)
(AD-702509; AFCRL-70-0099) Avail: CFSTI CSCL 12/1

The intention of the report is to summarize the data analysis, numerical analysis and programming performed in the solution of varied scientific problems during this year. These problems range in complexity from the numerical approximation of complicated double and triple integrals and numerical solutions for systems of non-homogeneous integral equations using integral approximations, to the classical solution of a system of non-homogeneous equations and the root solutions of polynomials with varying coefficients. Each problem encountered is presented in capsule form and its solution is outlined. It should be noted that, as of this report, a number of these problems, because of their complexity and continuing character, are still being analyzed. Author (TAB)

N70-27422# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Hypersonic Research Lab.
OPTIMUM CONTROL OF DISTRIBUTED PARAMETER SYSTEMS WITH TWO INDEPENDENT VARIABLES Final Report
Duncan M. Mc Intosh (Ph.D. Thesis—Arizona Univ.) Nov. 1969 143 p refs
(AD-702519; ARL-69-0195) Avail: CFSTI CSCL 12/1

The modern methods of the Calculus of Variations are used to find the primary necessary conditions for optimal control. A general problem is formulated which involves: (1) state and control variables defined in a region R with the state variables described by partial differential equations, (2) conditions on the boundary of R which are, typically, the boundary conditions for the interior partial differential equations, and (3) algebraic equations which must hold at the corner points of the boundary of R. A standard format is developed in which a large number of problems may be stated. Once a problem is stated in this standard format the formulae obtained in the dissertation gives a complete system of partial differential equations together with boundary conditions which when solved will yield the optimal control sought. The method is equally applicable to elliptic, parabolic, and hyperbolic partial differential equations. Example problems demonstrate: (1) control within the interior of a region, (2) control using state variables on the boundary, (3) control by varying the shape of the boundary, (4) control with variables defined only on the boundary, and (5) control using quasi-control variables. A final example demonstrates the agreement of the general method developed in the dissertation with a specific method developed by A. I. Egorov. Author (TAB)

N70-27466# Sandia Corp., Albuquerque, N.Mex.
EVALUATION OF PROBABILITIES ASSOCIATED WITH A FIXED SAMPLE SELECTION PROCEDURE
Donald E. Amos and Sharon L. Daniel Dec. 1969 50 p refs
(SC-RR-69-752) Avail: CFSTI

The sampling procedure under consideration consists of making m observations on each of $k + 1$ exponentially distributed populations, k of which have means of one while the $(k + 1)$st has mean theta > 1. The object is to identify the $(k + 1)$st population by summing the m independent observations for each sample and picking the population based on the largest sample sum. An integral for the probability of a correct selection is developed for this procedure. An analysis for the quadrature is presented together with a computer code which produces the sample size m needed to achieve a probability alpha of correct selection given k and tahta. Representative results are tabulated for alpha = 0.90, 0.95, 0.99, 0.995, 0.999 with $k + 1 = 2, 10, 100, 500, 1000$ and theta = 1.10, 1.25 (0.25) 3.00. Author (NSA)

N70-27480# France. Ministere de l'Air, Paris. Centre de Documentation de l'Armement.
DISCUSSION ON NUMERICAL CALCULATIONS AND APPLIED MATHEMATICS [COLLOQUE DE CALCUL NUMERIQUE ET MATHEMATIQUES APPLIQUEES]
1969 59 p refs In FRENCH Colloq. held at Tours, France, 1965
(NT-170) Avail: CFSTI

CONTENTS:

1. ON THE NUMERICAL CALCULATION OF PERIODIC SOLUTIONS FOR DIFFERENTIAL EQUATIONS L. Derwidue (Mons Univ.) p 1–5 refs (See N70-27481 13-19)
2. TEST ON THE PRANDTL INTEGRODIFFERENTIAL EQUATION C. Jacquin p 7–16 refs (See N70-27482 13-19)
3. IN REGARD TO RIABOUCHINSKY'S IMAGINARY NUMBERS P. Vernotte p 17–21 (See N70-27483 13-19)
4. IN REGARD TO TRACHTENBERG SPEED CALCULATIONS J. Nicoletis and J. Nicoletis p 23–30 refs (See N70-27484 13-19)
5. DETERMINATION OF ANNUAL MOVEMENT OF VISUAL COMPANION DOUBLE STARS WHOSE ORBIT IS CALCULATED BY THE THIELE-INNES METHOD S. Arend (Belg. Roy. Obs.) p 31 ref
6. ORBIT DETERMINATION OF VISUAL DOUBLE STARS WITH THE AIDE OF AN ELECTRONIC DEVICE S. Arend (Belg. Roy. Obs.) p 33 ref
7. STUDY OF VIBRATION MECHANICS BY THE MASS CONCENTRATION METHOD F. Salles (Lyon Univ.) p 35–47 ref (See N70-27485 13-19)
8. MATHEMATIC MAIEUTIC P. Vernotte p 49–54 ref (See N70-27486 13-19)

N70-27481# Mons Univ. (Belgium). Faculte Polytechnique.
ON THE NUMERICAL CALCULATION OF PERIODIC SOLUTIONS FOR DIFFERENTIAL EQUATIONS [SUR LE CALCUL NUMERIQUE DES SOLUTIONS PERIODIQUES DES EQUATIONS DIFFERENTIELLES NON LINEAIRES]
L. Derwidue *In* France. Min. de l'Air Discussion on Numerical Calculations and Appl. Math. 1969 p 1–5 refs In FRENCH (See N70-27480 13-19)
Avail: CFSTI

A method for obtaining a stable periodic asymptotic solution for nonlinear differential equations is considered. This method transforms the differential equation into a nonlinear inextricable algebraic problem from which the number of parameters are determined. The variational problem of Ritz is also considered. Transl. by J.M.C.

N70-27482# France. Ministere de l'Air, Paris. Centre de Documentation de l'Armement.
TEST ON THE PRANDTL INTEGRODIFFERENTIAL EQUATION [ESSAIS SUR L'EQUATION INTEGRODIFFERENTIELLE DE PRANDTL]
Claude Jacquin *In its* Discussion on Numerical Calculations and Appl. Math. 1969 p 7–16 refs In FRENCH (See N70-27480 13-19)
Avail: CFSTI

The circulation function in all given points of an extended wing is considered in order to resolve the Prandtl problem. The two essential types of Prandtl problems cited are: those that do not indicate a calculation procedure in view of practical application and approximation methods that do not allow the known errors to be introduced. The basis of this solution involves reducing the Prandtl equation to a linear differential equation in the close union of a complex variable. This method is effectively applied in the case of elliptic and rectangular wings. Emphasis is placed on obtaining a solution with known errors. Transl. by J.M.C.

N70-27483# France. Ministere de l'Air, Paris. Centre de Documentation de l'Armement.
IN REGARD TO RIABOUCHINSKY'S IMAGINARY

NUMBERS [A PROPOS DES NOMBRES IMAGINAIRES DE D. RIABOUCHINSKY]
Pierre Vernotte *In its* Discussion on Numerical Calculations and Appl. Math. 1969 p 17–21 In FRENCH (See N70-27480 13-19)
Avail: CFSTI

A trigonometric analysis of the Riabouchinsky imaginary number is presented in terms of the Fourier series. The equation treated by the Fourier series involves the absolute fluid velocity value with a special kind of complex number. Transl. by J.M.C.

N70-27484# France. Ministere de l'Air, Paris. Centre de Documentation de l'Armement.
IN REGARD TO TRACHTENBERG SPEED CALCULATIONS [A PROPOS DES CALCULS-ECLAIRS DE TRACHTENBERG]
John Nicoletis and J. Nicoletis *In its* Discussion on Numerical Calculations and Appl. Math. 1969 p 23–30 refs In FRENCH (See N70-27480 13-19)
Avail: CFSTI

The synthesis of conventional, algebraic, and Trachtenberg multiplication methods is presented. Associative and commutative methods were used to obtain partial product combinations for the different systems. Transl. by J.M.C.

N70-27485# Lyon Univ. (France).
STUDY OF VIBRATION MECHANICS BY THE MASS CONCENTRATION METHOD [ETUDE DES VIBRATIONS MECANIQUES PAR LA METHODE DE CONCENTRATION DES MASSES]
Francisque Salles *In* France. Min. de l'Air. Discussion on Numerical Calculations and Appl. Math. 1969 p 35–47 ref In FRENCH (See N70-27480 13-19)
Avail: CFSTI

An example of theoretical mathematics applied to vibration mechanics in beam separation is considered. In order to obtain a valuable numerical calculation the beam was split into a large number of parts allowing the introduction of an inertial means with the mass concentration in the center. The calculation was performed using the Maxwell equation and by substituting the inertia constant for the inertia variable. The resulting matrice calculations were performed on an IBM computer. Good agreement was obtained between experimental and theoretical results. Transl. by J.M.C.

N70-27486# France. Ministere de l'Air, Paris. Centre de Documentation de l'Armement.
MATHEMATIC MAIEUTIC [LA MAIEUTIQUE MATHEMATIQUE]
Pierre Vernotte *In its* Discussion on Numerical Calculations and Appl. Math. 1969 p 49–54 ref In FRENCH (See N70-27480 13-19)
Avail: CFSTI

A philosophical discussion on the improvement of the mathematical tools is presented. The conditions surrounding the partial derived equation is philosophically considered in order to show the indirect results of sharp change of the intervention factor in terms of the general laws of nature. Transl. by J.M.C.

N70-27496 France. Ministere de l'Air, Paris. Centre de Documentation de l'Armement.
STATISTICAL ANALYSIS OF A LARGE AMOUNT OF CORRELATED INFORMATION RELATED TO SPACE RESEARCH [ANALYSE STATISTIQUE D'UN GRAND NOMBRE D'INFORMATIONS CORRELATIVES CONCERNANT LES ETUDES SPATIALES]
B. I. Soukhoroutchenkov [1969] 23 p refs Transl. into FRENCH from Kosmich. Issled (Moscow), v. 7, no. 1, 1969 p 75–83 In FRENCH and RUSSIAN
Copyright. Avail: Issuing Activity

The problem of the processing of statistical data obtained from a large number of correlated measurements is considered and it is shown that it is difficult to apply the method of maximum probability directly to this problem but the least squares method can be used. The choice of the optimal input path and the statistical processing of measurement results are studied. In addition the properties of correlated functions limiting the stationary random functions are briefly treated. ESRO

N70-27547# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
PARAMETRIZATION OF UNITARY AND STATISTICAL WEIGHT
V. M. Mal'tsev 1969 6 p refs In RUSSIAN
(JINR-P2-4845) Avail: AEC Depository Libraries

Projection of an integral state, containing an arbitrary number of octets and decuplets is represented by the integral on parameter space of the symmetry group. Author (NSA)

N70-27551# Idaho Nuclear Corp., Idaho Falls.
PROJ: ALGORITHM AND COMPUTER PROGRAMS FOR THE HIDDEN LINE PROBLEM FOR SINGLE VALUED SURFACES
M. A. Lintner Dec. 1969 40 p refs
(Contract AT(10-1)-1230)
(IN-1342) Avail: CFSTI

The hidden-line problem in this case is to find an efficient computer algorithm that will determine which line segments, or parts of line segments, are visible from a given vantage point. An algorithm which was written to handle this special but important case of the general hidden line problem is described. It is also intended that this will serve as the user's guide for the computer programs based on the algorithm. Author (NSA)

N70-27567# Nebraska Univ., Lincoln.
A GENERALIZATION OF ALMOST DEDEKIND DOMAINS
Max D. Larsen [1969] 12 p refs
(Grant NSF GP-8932)
Avail: Issuing Activity

A valuation theory of Manis is used to generalize the notion of almost Dedekind domain to rings which have zero divisors. The generalization is then compared to almost multiplication rings and is used to prove that overrings of almost multiplication rings are almost multiplication rings. All rings are assumed to be commutative and have identity. An overring of a ring R is a ring between R and its total quotient ring. For a prime ideal P of R, N(P) denotes the set of all x in R such that xs = 0 for some s in R and P. Author

N70-27568# Nebraska Univ., Lincoln.
MAXIMAL PARTIAL HOMOMORPHISMS AND VALUATION PAIRS
Patrick H. Kelly and Max D. Larsen [1969] 8 p refs
(Grant NSF GP-8932)
Avail: Issuing Activity

A valuation theory is generalized for characterization of valuation rings as domains of maximal partial homomorphisms. A partial answer is given to a question concerning places in finite and infinite primes for rings and fields. All rings considered are commutative and have a unity element. If K is a ring, a valuation pair of K is defined as a pair (V,P), where V is a subring of K and P is a prime ideal of V, satisfying any of the given equivalent conditions. Author

N70-27617# Rome Univ. (Italy). Inst. of Physics.
ON THE REGGEIZED MULTIPERIPHERAL MODEL

S. Ferrara (CNEN, Frascati) and G. Mattioli 1 Dec. 1969 20 p refs *Its* Nota Interna 245
Avail: CFSTI

The problem of the convergence of the unitarity sum, saturated with Reggeized multiperipheral graphs, is formulated in a clear mathematical way. The asymptotic approximation is extensively treated. Author (ESRO)

N70-27629# Purdue Univ., Lafayette, Ind.
COHOMOLOGY OPERATIONS IN LOCAL COEFFICIENT THEORY
Jerrold Siegel [1969] 24 p refs
(Grant NSF GP-6599)
Avail: Issuing Activity

Computation of a group of cohomology operations by a modified Serre spectral sequence is investigated. An alternate formulation of the spectral sequence is presented as the spectral sequence of a bigraded module, and the two filtrations that such a module presents are then studied. The second filtration permits extensive computations and exhibits the relation between the equivariant cohomology theories and the given investigations. Author

N70-27632# Purdue Univ., Lafayette, Ind.
EXTENDING HOMEOMORPHISMS
Jerome L. Paul [1969] 7 p refs Supported in part by NSF
Avail: Issuing Activity

A necessary and sufficient condition is established that a locally flat imbedding of a k-cell in a Euclidean n-space admits an extension to a homeomorphism onto the n-space such that the difference of the flat imbedding in the homeomorphism is a diffeomorphism which is the identity outside some compact set in the n-space. An analogous result for locally flat imbeddings of a Euclidean (n-1)-sphere into the n-space is proved. A lemma which generalizes a theorem of Huebsch and Morse concerning Schoenflies extensions without interior differential singularities is also established. Author

N70-27635# Purdue Univ., Lafayette, Ind.
ON THE CONSTRUCTION OF G-SPACES AND APPLICATIONS TO HOMOGENEOUS SPACES
Daniel Henry Gottlieb 15 May 1969 15 p refs
(Grant NSF GP-6599)
(Rept-69117) Avail: Issuing Activity

A G-space is defined and is considered to be a weaker notion than that of an H-space. It is shown that the n-connective covering of a G-space is a G-space and two-stage Postnikov systems which are G-spaces are demonstrated. Finite dimensional G-spaces are constructed by considering homogeneous spaces. For the case when T is a toroidal subgroup of a Lie group G, it is shown that G/T is a G-space if and only if pi sub 2 (G/T) = 0. The stated theorem is proved. Author

N70-27657# Stanford Univ., Calif. Dept. of Computer Science.
STATIONARY VALUES OF THE RATIO OF QUADRATIC FORMS SUBJECT TO LINEAR CONSTRAINTS
Gene H. Golub and Richard Underwood Nov. 1969 22 p refs Sponsored in part by AEC
(TID-25317; CS-142) Avail: CFSTI

Let A be a real symmetric matrix of order n, B a real symmetric positive definite matrix of order n, and C an $n \times p$ matrix of rank r with $r < \text{or} = \text{to } p < n$. An algorithm is given for generating a symmetric eigensystem whose eigenvalues are the stationary values and for determining the vectors x. Several Algol procedures are included. Author (NSA)

N70-27675 Kansas Univ., Lawrence.
ON GENERALIZATIONS OF FC-GROUPS
John Albert Wenzel (Ph.D. Thesis) 1969 44 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-21594

Limiting conditions are presented for the existence of an FC-group and for all ordinal functions of this group. Definitions are given for an ascending FC-central series for the group and for an FC-nilpotent of an FC-class and an FC-hypercentral for an FC-class. A residually FC-central group is also defined. Proof is given for the existence of normal FC-hypercentral and FC-nilpotent subgroups. Characteristics of terms in an ascending FC-central series and an ascending series of a direct product of groups are given. Proof is also given for the existence of a finite FC-central group which is in the FC-center. Dissert. Abstr.

N70-27677# Electronic Associates, Inc., Brussels (Belgium). European Computation Center.
ON THE TREATMENT OF OPTIMIZATIONS BY MEANS OF PONTRYAGIN'S MAXIMUM PRINCIPLE ON A HYBRID COMPUTER [ZUR BEHANDLUNG VON OPTIMIERUNGEN NACH DEM PONTRYAGINSCHEN MAXIMUMPRINZIP AUF DEM HYBRIDRECHNER]
Werner Bub *In* DVFLR Symp. on Hybrid Computers in Aeron. and Astronaut., Pt. 2 May 1969 p 7-45 refs In GERMAN
(See N70-27676 13-08)
Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 46.90 DM

After an outline of the theory of Pontryagin's principle, it is applied to a basic problem of rocket thrust vector control taking into account the practical solution by means of a hybrid computer. The boundary value problem emerging from the procedure can only be solved by iterative methods which consist of adding stochastic disturbances to the parameter vectors to obtain convergence. A Newton matrix method is used for the iteration. ESRO

N70-27799# Stanford Univ., Calif. Dept. of Operations Research.
COUNTABLE STATE DISCOUNTED MARKOVIAN DECISION PROCESSES WITH UNBOUNDED REWARDS
John M. Harrison 12 Mar. 1970 36 p refs
(Contracts Nonr-225(53); Nonr-225(89); Grant NSF GK-2825)
(AD-702409; TR-128) Avail: CFSTI CSCL 12/2

Countable state, finite action Markov decision processes are investigated under a criterion of maximizing expected discounted rewards over an infinite planning horizon. Well-known results of Maitra and Blackwell are generalized, their assumption of bounded rewards being replaced by the following weaker condition: the expected absolute reward to be received at time n+1 minus the actual absolute reward received at time n (as a function of the state of the system of time n, the action taken at time n, and the decision rule to be followed at time n+1) can be bounded above. Under this condition it is shown that the expected discounted reward (over the infinite planning horizon) from each policy is finite and that there exists a stationary policy which is optimal. Additional results are presented concerning the policy improvement and successive approximations algorithms for computation of optimal policies. All of these results are extended to Markov renewal decision processes under one additional condition on the transition time distributions. As in Blackwells work on discounted dynamic programming a central role is played by Banachs fixed point theorem for contraction mappings. Examples are presented of inventory and queueing control problems which satisfy our assumptions but do not exhibit bounded rewards. Author (TAB)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N70-26511# Environmental Science Services Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
ELECTRIFICATION PROCESSES IN WARM RAIN CLOUDS
Lothar H. Ruhnke (Ph.D. Thesis—Hawaii Univ.) Feb. 1969 111 p refs
(ESSA-TR-ERL-103-APCL-5) Avail: SOD $1.00

The problem of electrical charges on raindrops from non-thunderstorm clouds is investigated. Measurements of charges on Hawaiian rain are discussed together with observations of electric field and condensation nuclei profiles. It was found that positive charges are of the order of 0.0001 esu. A correlation of these charges with wind speed was found. Electric fields in rain clouds are generally positive except at the lower cloud boundary where negative fields of up to 1000 V/m exist. Several thunderstorm theories are discussed and their applicability to the warm rain mechanism is examined. A hypothesis is necessary to explain the observed electrical features of warm rain. A theory based on influence is formulated. Numerical solutions to drop charges and electric field profiles using a realistic cloud model were obtained through the use of digital computer techniques. The theoretical results for charges on raindrops and electric field patterns agree well with observations. Author

N70-26527# Sandia Corp., Albuquerque, N. Mex.
FALLING SPHERE AS AN ATMOSPHERIC MEASUREMENT TECHNIQUE
Lawrence B. Smith 9 Dec. 1969 29 p refs
(SC-DC-69-2102) Avail: CFSTI

The equipment and methods in the falling sphere program for measuring atmospheric temperatures and densities at altitudes from 30 to 110 km and winds at altitudes from 30 to 70 km are described. The 66 cm dia non-instrumented spheres made of radar reflective Mylar were rocket launched to the desired altitude, ejected from the rocket, automatically inflated with isopentane, and radar tracked throughout their descent. The method used to compute atmospheric density from radar measurements of the acceleration and velocity of the falling sphere is described. The computed densities were, in turn, used in the perfect gas equation to calculate the atmospheric temperature. Of the 30 experiments conducted with falling spheres between 1964 and 1969, 21 were successful for obtaining density, temperature, and wind data. It was concluded that the falling sphere technique is a reliable and economical method of observing the neutral atmosphere up to approximately 100 km. NSA

N70-26541 National Lending Library for Science and Technology, Boston Spa (England).
THE EVOLUTION OF MONTHLY MEAN PRESSURE WAVES IN THE NORTHERN HEMISPHERE AND MONTHLY MEAN TEMPERATURE
B. R. Ur'eva 28 Nov. 1969 26 p refs Transl. into ENGLISH from Glav. Geof. Obs. (Leningrad), v. 245 p 99 125
(NLL-M-7943-(5828.4)) Avail: Natl. Lending Library, Boston Spa, Engl.: .3 NLL photocopy coupons

An analysis is given of the distribution, by seasons and months, of the air pressure wave system over the Northern Hemisphere, for a 19-year period. Special reference is made to the change of position of the associated ridges and troughs in the normal climatic sequences throughout the three months of each season, and likely monthly sequences following anomalous behavior of the troughs and ridges in any month are also discussed. It is found that the probabilities of recurring seasonal patterns can be allotted with good statistical reliability, using the departure of the H sub 500 geopotential from normal latitude values. The value of a circulation index within or outside a standard range of values is an important deciding criterion. Author

N70-26549 National Lending Library for Science and Technology, Boston Spa (England).
SOME CONSIDERATIONS REFERRING TO THE TENDENCY FOR VARIATION OF AIR TEMPERATURE AS AN EFFECT OF THE DEGREE OF URBANISATION OF BUCHAREST
S. M. Stoenescu et al 28 Nov. 1969 8 p refs Transl. into ENGLISH from Rumania Report
(NLL-M-7956-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The method of sliding means using thirty year intervals was utilized to prove a systematic air temperature increase over Bucharest in comparison with the surrounding country site. Respective differences revealed variations in time related to oscillations in the direction of air advection and to efficiency zones of specific processes in the town. Chronological sequences of annual sums of the mean daily positive temperature presented a trend of generally continuous growth. This effect was attributed to urbanization effects on the meteorological regime over the city. G.G.

N70-26770# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
DETERMINATION OF THE TEMPERATURE AND PRESSURE OF THE LIFTING CONDENSATION LEVEL
Walter S. Nordquist, Jr. Fort Monmouth, N.J. ECOM Nov. 1969 39 p refs
(AD-700953; ECOM-5282) Avail: CFSTI CSCL 4/2

Three methods, two iterative and one algebraic approximation, for the determination of the lifting condensation level temperature and pressure are presented. A comparison of the results of these three numerical methods and the results obtained using standard graphical techniques is made for a wide range of initial conditions of temperature and moisture content. The comparison indicates that the mixing ratio iterative technique where the precision of the mixing ratio of the lifted condensation level can be preselected provides the closest answers. However, the more easily applied algebraic approximation is adequate for practical purposes over a wide range of initial conditions. Author (TAB)

N70-26846# Air Force System Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LENINGRAD SCIENTIFIC RESEARCH INSTITUTE OF HYDROMETEOROLOGICAL INSTRUMENT MANUFACTURE. INFORMATIVE MATERIALS ON HYDROMETEOROLOGICAL INSTRUMENTS AND OBSERVATION METHODS
V. Yu. Torochkov 10 Oct. 1969 19 p refs Transl. into ENGLISH from the Russian
(AD-700597; FTD-MT-24-192-69) Avail: CFSTI CSCL 4/2

Contents: Average values of wind velocity, wind direction and their measurement; and on the structural designs of instruments for determining wind direction. TAB

N70-26913# Environmental Technical Applications Center (Air Force), Washington, D.C.
AN ANNOTATED CLIMATOLOGICAL BIBLIOGRAPHY OF THE BENELUX COUNTRIES 1960 – 1969
Dennis L. Boyer and Alvin L. Smith, Jr., comps. Feb. 1970 76 p refs
(AD-701692; ETAC-TN-70-2) Avail: CFSTI CSCL 4/2

The bibliography contains 132 climatological references concerning the BENELUX COUNTRIES PUBLISHED DURING THE PERIOD 1960-1969. Items are arranged alphabetically by author for each country and a section of general references is included. A subject index is furnished. Author (TAB)

N70-26942# Lincoln Lab., Mass. Inst. of Tech., Lexington.
REPORT ON A WEATHER RADAR STUDY FOR AEROSPACE INSTRUMENTATION PROGRAM OFFICE (ESSI)

ELECTRONIC SYSTEMS DIVISION Technical Note
James W. Meyer 5 Feb. 1970 76 p refs
(Contract AF 19(628)-5167)
(AD-701742; TN-1970-5; ESD-TR-70-7) Avail: CFSTI CSCL 4/2

The report presents the conclusions and recommendations of an ad hoc study group which investigated the problems and opportunities of providing improved airborne severe storm reconnaissance with special emphasis on airborne radar detection and surveillance of hurricanes. Study group recommendations are made in terms of what can and should be done in three epochs: by the 1970 hurricane season, by the 1971 hurricane season, and by the 1972 hurricane season. Several options are listed to allow some flexibility in choice of implementation. Discussion of the rationale is also included, and suggestions of desirable improvements in areas other than radar are made. A rudimentary radar hurricane model is presented to aid in the analysis of competing systems, and the implications on radar design of the radar requirements as presented are discussed. Author (TAB)

N70-26955# New York Univ., N.Y. Geophysical Sciences Lab.
A STRUCTURED FLUIDS APPROACH TO CANOPY FLOW
Mark N. Silbert Jan. 1970 29 p refs
(Contract Nonr-285(57))
(AD-701708; GSL-TR-70-2) Avail: CFSTI CSCL 4/2

The classical turbulence approach to the flow of air in a vegetative canopy is reviewed. Three separate classical theories are described. A comparison is made between experimentally measured canopy flows and a velocity function derived from the theory of structured continua. The agreement between theory and observations is good, but not unexpected, due to seven degrees of freedom in the fitted velocity profile. Proposals for future study for a more rigorous test of the theory are discussed. Author (TAB)

N70-26988# Washington Univ., Seattle. Coll. of Forest Resources.
DISPERSION OF AIR TRACES INTO AND WITHIN A FORESTED AREA, VOLUME 1 Technical Report
Leo J. Fritschen, Charles H. Driver, Charles Avery, John Buffo, and Robert Edmonds Sep. 1969 45 p refs
(Contract DA-AMC-28-043-68-G8)
(AD-700974; ECOM-68-G8-1) Avail: CFSTI CSCL 4/2

Dispersion of fluorescent powders, dyes and spores from a clearcut area into and within a 45-year old Douglas-fir forest was studied under various meteorological conditions. A total of 111 rotorods samplers were used to trap the tracers within a canopy volume of 20 m height, 210 m width and 270 m length. Wind speed, direction and air temperature were monitored on five towers on a line perpendicular to the forest wall. Twenty-four multiple location releases were made during 1968 and 1969. Part 1 describes the experimental site, procedures and methods. Part 11 contains data collected and Part 111 results, discussion and conclusions. Author (TAB)

N70-26990# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
INSTABILITY OF ROTATIONAL AND GRAVITATIONAL MODES OF OSCILLATION Scientific Report
T. J. Simons and Desiraju B. Rao Jan. 1970 28 p refs *Its* Atmospheric Sci. Paper No. 155
(Contract F19628-68-C-0104; Grant NSF-GA-11637)
(AD-701745; AFCRL-70-0078; SR-3) Avail: CFSTI CSCL 4/1

The problem of dynamic stability of small amplitude motions on a two-fluid system with a free surface is considered. For the case of no rotation the character of the Kelvin-Helmholtz instability is remarkably different as compared to systems where the external gravitational modes are absent either through the mechanism of filtering or by imposing a rigid top. In the case of a constant rotation, it is shown that the instabilities on a wave length - shear plane consist of regions where only the gravitational modes or only the rotational modes or both independently are unstable, in addition to regions where instabilities are generated by an interaction between the gravitational and rotational modes. Author (TAB)

N70-27035# Air Force Cambridge Research Labs., Bedford, Mass.
WEATHER TRACKING WITH THE AFCRL EXPERIMENTAL 3-D RADAR
W. G. Mavroides Jan. 1970 23 p refs
(AD-701398; AFCRL-IP-163; AFCRL-70-0006) Avail: CFSTI CSCL 4/2

Experimental work using the AFCRL 3-D Radar, based on the Phase-in-Space principle, as a Weather Radar is presented. Snow and rain storms are tracked and documented by photographs taken from a conventional plan-position-indicator display scope (PPI) and compared with the presentations from the 3-D Radar range-height-indicator scope (RHI). In addition, the sensitivity and response of the phase-in-space principle is clearly depicted with the detection of cloud areas and separation of cloud layers of different densities. Also, evidence is presented showing the superiority of the RHI presentations in differentiating targets in the midst of storms over the conventional PPI display. Author (TAB)

N70-27039# Texas Univ., Austin. Electrical Engineering Research Lab.
SKY TEMPERATURE MEASUREMENTS PROGRAM AT 67 GHZ Final Report, 1 Apr. 1966 – 31 May 1969
Donnie Joe Pounds and John R. Cogdell 31 Oct. 1969 83 p refs
(Contract AF 19(628)-5908)
(AD-701404; AFCRL-69-0510) Avail: CFSTI CSCL 4/2

A measurements program in atmospheric emission profiles is described. The goal of the research was to obtain accurate data toward remote probing of atmospheric temperature profiles. The theory underlying such measurements is presented and the design of the experiment is discussed. The equipment, procedures, and data analysis used in the proper methods are discussed. Particular emphasis is placed on the antenna properties. Selected data are tabulated in the report, along with simultaneous surface and sonde measurements. The data are discussed with regard to antenna effects, terrain effects, and miscellaneous meteorological effects. Author (TAB)

N70-27083*# Radiometric Technology, Inc., Cambridge, Mass.
AN ANALYSIS OF AIRBORNE MICROWAVE RADIOMETRIC DATA Final Report
7 Feb. 1970 130 p refs
(Contract NAS5-11685)
(NASA-CR-109846) Avail: CFSTI CSCL 04B

Data from measurements taken in 1967, 1968, and 1969 over ocean and land areas by a 19.35 GHz phased-array scanner aboard the NASA Convair 990 are analyzed. Of particular interest are data which relate to the radiation emitted and affected by clouds. Other data from sensors measuring energy at IR wavelengths, temperature in situ, and, for the flights in 1969, energy at 9.3 GHz, are utilized to reconstruct atmospheric, surface, and cloud characteristics. Theoretical brightness temperatures derived from cloud models, consistent with the physical data available, are in general agreement with the brightness temperatures observed over ocean areas. Although a somewhat limited effect is evidenced by clouds over dry bare soil and vegetation areas, a reasonably pronounced effect appears possible over moist soils. Analysis of those cases in which computed brightness temperatures do not match the observed brightness temperatures indicates either: (1) the existence of cloud droplets larger than can be treated successfully by the simple Rayleigh theory utilized; or (2) the incompleteness of the cloud models themselves. Author

N70-27096# National Lending Library for Science and Technology, Boston Spa (England).

ON TURBULENT GRAVITATIONAL COAGULATION OF CLOUD DROPLETS

L. M. Levin et al 28 Nov. 1969 8 p refs Transl. into ENGLISH from Ak. Nauk (Moscow), v. 164, 1965 p 552–555
(NLL-M-7961-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The combined effect of turbulent and electrostatic coagulation on the rate of growth of cloud droplets is estimated. An estimate is made for a two-level model in which the space outside the large droplet is divided into two parts by a sphere standing at a distance from the drops equal to the turbulent length of the free path of the particles. The Cartesian coordinates of the droplet centers are determined from a system of nondimensional equations. J.M.C.

N70-27098# National Lending Library for Science and Technology, Boston Spa (England).

ON THE INFLUENCE OF THE AVERAGING TIME ON THE ACCURACY OF AN INERTIAL INSTRUMENT

L. L. Braginskaja 28 Nov. 1969 7 p refs Transl. into ENGLISH from Glav. Geof. Obs. (Leningrad), v. 228 p 121–130
(NLL-M-7955-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

An estimation of how accurately averaged readings represent mean values of the meteorological elements if the time correlation function of the meteorological element can be described by an exponential function is considered. Relative errors for instantaneous and averaged readings of inertial instruments are discussed. J.M.C.

N70-27099# Environmental Science Services Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.

SILANES AS CLOUD STABILIZERS

Charles C. Van Valin and Paul A. Allee Apr. 1969 38 p refs
(ESSA-TR-ERL-105-APCL-6) Avail: SOD $0.30

Among 14 silane compounds tested, the alkyltrichlorosilanes proved most efficient in stabilizing cloud droplets against evaporation. The mode of action is apparently a reaction of the silane with water at the surface of a droplet to form a silicone polymer film that lowers the water vapor pressure over the surface. The reduction of vapor pressure was demonstrated by experiments, which showed that the dewpoint is lowered in a silane-treated cloud and over a silane-treated plane water surface. Substances that are effective as cloud stabilizers were also found to be effective in preventing the nucleation of ice crystals by AgI ice nuclei in a supercooled cloud. Author

N70-27108# National Lending Library for Science and Technology, Boston Spa (England).

A TECHNIQUE FOR CALCULATING INTENSITY OF PRECIPITATION

R. Baker 28 Nov. 1969 8 p refs Transl. into ENGLISH from Glav. Geof. Obs. (Leningrad), v. 247, 1969 p 71–75
(NLL-M-7842-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Indirect methods for determining precipitation intensities and its statistical structure based on taking account of relationships between different precipitation characteristics such as, the monthly precipitation total, the number of days with precipitation, and the total duration of precipitation for the month are discussed. The accuracy of the proposed method of calculation depends on the length of the period of observation for which simultaneous data is available. From preliminary estimates a 10% error in the mean data can be obtained with an observational period of 35–40 years. J.M.C.

N70-27235# Argonne National Lab., Ill. Dept. of Air Pollution Control.

AN URBAN ATMOSPHERIC DISPERSION MODEL

J. J. Roberts, E. J. Croke and A. S. Kennedy Oct. 1969 116 p refs
(Contract w-31-109-eng-38)
(ANL/ES-CC-5) Avail: CFSTI

A multiple source, computerized atmospheric dispersion model designed for operational use in air resource management has been formulated and programmed for the IBM 360-75 system. The development and preliminary validation testing of the model is described against data from a three-year, computerized inventory of sulfur dioxide air quality data recorded by the re . ptors of the Chicago, Illinois, telemetered air monitoring system. A detailed, two-year inventory of Chicago coal and oil burning SO2 emission sources was acquired, data storage formats were designed, and computer algorithms were developed to generate hourly average estimates fo emission from major utility, industrial, residential, commercial, and institutional sources. Small emitters were aggregated into square mile area sources. Hourly time series plots of observed and actual SO2 concentrations indicate that the model is sufficiently accurate to test selective hypotheses about the model itself and to evaluate urban air resource management strategies. Author

N70-27237 National Lending Library for Science and Technology, Boston Spa (England).

A COMPARISON OF RESULTS OF THE OBJECTIVE ANALYSIS OF CONTOUR CHARTS OBTAINED IN OPERATIONAL WORK IN DIFFERENT COUNTRIES

K. M. Lugina 28 Nov. 1969 13 p refs Transl. into ENGLISH from Glav. Geof. Obs. (Leningrad), v. 238, 1968 p 154–165
(NLL-M-7970-(5258.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL Photocopy coupons

Objective analysis of weather charts refers to the process of finding values of meteorological elements at the grid of points of a regular network and drawing isopleths for a given element in the basis of meteorological observations at stations. The accuracy of objective analysis of synoptic and upper air charts is discussed because the sense of a numerical forecast depends substantially on the quality of the analysis. The methods of objective analysis compared include optimal interpolation, successive approximation, polynomial approximation, and expansion of spherical functions. Author

N70-27238 National Lending Library for Science and Technology, Boston Spa (England).

TEMPERATURE ANOMALIES IN SPRING MONTHS PRECEDING SIMILAR NOVEMBERS

L. G. Borisova 28 Nov. 1969 12 p refs Transl. into ENGLISH from Glav. Geof. Ibe. (Leningrad), v. 245, 1969 p 8–13
(NLL-M-7944-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Analysis of operational testing of the methods of forecasting anomalies in mean monthly air temperature based on a matching set of analogies, points to the necessity for a differentiated approach to each individual month or at least to each season. The need to take history into account, when compiling a forecast of anomaly in the mean monthly air temperature, has been confirmed. A link between temperature anomalies in November and temperature analogy of the springs months (March, April, May) has been established. The probability factor for this relationship was found to be 88%. Author

N70-27280# National Meteorological Center, Suitland, Md.

NOISE ANALYSIS OF A LIMITED-AREA FINE-MESH PREDICTION MODEL

Joseph P. Gerrity, Jr. and Ronald D. Mc Pherson Feb. 1970 84 p refs
(ESSA-TM-WBTM-NMC-46) Avail: CFSTI

A diagnostic study of the mechanisms responsible for producing high wavenumber oscillations (noise) in the numerical solution of the nonlinear equations governing a free surface, barotropic, atmospheric model is reported. The oscillations are identified as predominantly the result of the lattice structure of the difference equations and the boundary conditions employed to specify the solution. The analytic methods employed involved the use of space and time sections of the numerical solutions to provide a set of hypotheses. These are tested utilizing a one-dimensional linear analog of the model equations. The solution of the linear equations is obtained analytically, by the method of characteristics, and numerically. Several possibilities for removing the noise are suggested. Some improvement is demonstrated when the suggested methods are used in the linear one-dimensional analog. Author

N70-27357# Technische Hochschule, Karlsruhe (West Germany). Meteorologisches Inst.
EXPERIMENTAL INVESTIGATIONS OF THE INFLUENCE OF HIGH dc-VOLTAGES ON ARTIFICIAL FOG [EXPERIMENTELLE UNTERSUCHUNGEN UEBER DEN EINFLUSS HOHER GLEICHSPANNUNGEN AUF KUENSTLICHE NEBEL]
Karl Heinz van der Linde (Ph.D. Thesis) 1968 78 p refs In GERMAN
Avail: CFSTI

The change of artificial clouds with drops of maximally 8 micrometers diameter and a water content of approximately 1 g/cu m under the influence of an electrostatic high voltage is measured by a line of sight method. The voltage leads to the formation of bigger drops. The experimental results show that the normal atmospheric electrical field of approx. 130 V/m does not change the drop spectrum in natural clouds and fog noticeably. As the formation of bigger drops also takes place due to separate voltage peaks, these phenomena probably are the solution to precipitation forming in thunderstorms. ESRO

N70-27358# Deutscher Wetterdienst, Munich (West Germany). Instrumentenamt.
DEVELOPMENT WORK IN THE FIELD OF AEROLOGICAL MEASURING TECHNIQUES [ENTWICKLUNGSARBEITEN AUF DEM GEIBIET DER AEROLOGISCHEN MESSTECHNIK]
Jun. 1969 53 p refs In GERMAN
Avail: CFSTI

The requirements and technical details for four different sonde systems, developed as precision radiosondes for discontinuous atmospheric temperature, pressure and moisture measurement, as well as a radiosonde for continuous temperature measurement, are described. Typical ascent examples are given. The single parameter radiosondes represent preliminary stages for an improved routine sonde system, with which the conventional three parameters (pressure, temperature and moisture) may be measured. Two alternative solutions are given which should lead to prototypes. The precision of aerological measurements and user requirements, as well as synoptical procedures and comparisons between routine sondes and precision measurement of air temperature are also discussed. ESRO

N70-27398# Fraunhofer-Gesellschaft, Garmisch-Partenkirchen (West Germany). Physikalisch-Bioklimatische Forschungsstelle.
[MEASUREMENT OF AIRBORNE AND PRECIPITATION RADIOACTIVITY AND METEOROLOGICAL APPLICATION]
Progress Report
18 Nov. 1969 24 p ref
(Contract AT(30-1)-4061)
(NYO-4061-1; PR-1) Avail: CFSTI

The meteorological significance of radioactivity in the atmosphere was studied. Literature on mass exchange in the atmosphere and world-wide transport of radioactive fallout was reviewed. Equipment was selected and installed for measuring fallout deposition and radioactivity and for identifying the Be-7 and P-32 content in the air. Initial data taken during Nov. 1969 is presented. NSA

N70-27400# National Air Pollution Control Administration, Arlington, Va. Div. of Meteorology.
ST. LOUIS DISPERSION STUDY. VOLUME 2: ANALYSIS
James L. Mc Elroy and Francis Pooler, Jr. Dec. 1968 56 p refs
(AP-53) Avail: Issuing Activity

The primary analyses performed on data collected during low-level tracer experiments are described. Values of dispersion parameters are related to readily derived or measured meteorological indices of turbulence. The results are graphically presented in terms of best-fit curves as functions of downwind distance and travel time. Comparisons are made with the results of previous diffusion experiments conducted over relatively uncomplicated terrain in open country. It is concluded that for low-level point sources the urban area affects crosswind dispersion primarily by enhancing the initial size of the plume. As the plume becomes much larger than the size of eddies created by the local obstructions, the dispersion approaches that associated with flow over open country. In the vertical, significantly enhanced dispersion as well as an enlarged initial spread of the tracer cloud seem to occur; this enhancement in the rate of dispersion over that in open country appears somewhat greater for stable than for unstable meteorological conditions. Values of dispersion parameters in other urban areas are similar to those for St. Louis. Author

N70-27412# Institut Royal Meteorologique de Belgique, Brussels.
OBJECTIVE ANALYSIS OF ATMOSPHERIC FIELDS USING CHEBYSHEV MINIMIZATION CRITERIA
Susan Boville (M.S. Thesis) 1969 40 p refs Sponsored jointly by NATO and NRC Prepared jointly with Mc Gill Univ. *Its* Publ. Ser. A, No. 69
Avail: CFSTI

An objective analysis scheme which uses specified functions for the representation of the observation data and computes the coefficients of functions utilizing the Chebyshev approximation method has been tested. In this study spherical harmonics were used to represent 500 millibar height observations for the Northern hemisphere. A further advantage of the scheme is the direct determination of the coefficients required as input for spectral forecast models. The results show that the scheme works very well in areas with abundant data. However, errors may arise in areas of sparse data such as the Pacific Ocean and Equatorial Regions. Problems in the latter region might be alleviated by the use of odd functions with their zero amplitudes at the equator. However, it has been shown that effective control can be attained by the addition of bogus data. In the test runs with bogus data in the sparse regions the analysis compared very well with the Central Analysis Office grid-point analysis over the whole of the Northern hemisphere. This scheme could be adopted for operational use providing further modifications were made to speed up the machine procedures, a factor of minor concern in the research experiment. Author (ESRO)

N70-27450# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik
INVESTIGATIONS OF THE EVALUATION OF SATELLITE PICTURES, ESPECIALLY OF THE ESTIMATION OF TROPOSPHERIC TEMPERATURE, PRESSURE AND HUMIDITY [UNTERSUCHUNGEN UEBER DIE AUSWERTUNG VON SATELLITENAUFNAHMEN, INSBESONDERE UEBER

DIE ABSCHAETZUNG DER TROPOSPHAERISCHEN TEMPERATUR-, DRUCK- UND FEUCHTEVERHAELTNISSE]
Horst Malberg (Ph.D. Thesis) 1969 202 p refs In GERMAN; ENGLISH summary *Its* Meteorol. Abhandl., Band 110, Heft 2
(Contract T-842-I-203)
Avail: CFSTI

The attempt has been made to contribute to quantitative picture interpretation with special accentuation of estimating temperature, pressure and humidity. As an introduction, some chapters deal with weather satellites, TV pictures, cloud patterns and cloud categories. A detailed discussion of a cyclone shows from beginning (wave stage) to its end over six days the qualitative relations between cloud formations and meteorological parameters. It has been proved useful for the further investigations to divide the vortices according to their appearances in satellite pictures in a developing stage, a mature stage, and a dissipating one. For these stages it is shown in which directions and distances in relation to the corresponding cloud masses the surface and 500-mb low centers can be expected. The main question of these studies is to find out, whether it is possible to estimate vertical temperature profiles and geopotential heights from TV pictures. For this reason a method (of approach) is demonstrated, which allows us to derive these values for some fixed points in highs, lows, and cold air pools from sea surface up to 300-mb. As the operational use of the shown method is possible, the calculated data will be of value as input parameters for numerical analysis and prediction over data-sparse areas. Furthermore average data of humidity of large scale cloud patterns are given. Further studies are made to give detailed informations about pressure gradient, wind estimation, tropopauses over lows and cold air pools, relative vortices, and special phenomena in cloud pictures. All appearances and all data, won by the given method of approach are used at last to construct surface maps and troposphere's geopotential height distribution from TV pictures.
Author (ESRO)

N70-27529# Koln Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
DIAGRAMS FOR THE DETERMINATION OF EXTRATERRESTRIAL SLOPE INSOLATION [DIAGRAMME ZUR BESTIMMUNG DER EXTRATERRESTRISCHEN HANGBESTRAHLUNG]
H. Heyne (Ph.D. Thesis) Jul. 1969 66 p refs In GERMAN *Its* Mitt. Heft 10
Avail: CFSTI

The computer calculation of the insolation of slopes is described, ignoring the influence of diffuse illumination. The diurnal means and mean values for longer periods are calculated and represented by means of graphs drawn by a computer controlled plotting machine. Interpolation and extrapolation from these graphs is described.
Author (ESRO)

N70-27588# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
VARIATIONS OF TEMPERATURE AND HUMIDITY ON A SERIES OF BRIGHT DAYS DURING THE SUMMER OF 1968 IN THE INNER CITY AND SUBURBS OF WEST BERLIN [VERLAUF VON TEMPERATUR UND FEUCHTE AN EINER REIHE VON HEITEREN TAGEN DES SOMMERS 1968 IN DER INNENSTADT UND IN DEN AUSSENBEZIRKEN WEST-BERLINS]
Bernd-Lothar Richter (Ph.D. Thesis) 1969 67 p refs In GERMAN; ENGLISH summary *Its* Meteorol. Abhandl., Band 110, Heft 3
Avail: CFSTI

Measurements of temperature and humidity were made in West Berlin during the summer of 1968 on three special places in built-up areas of the town and compared with those of two other places in outlying districts. Measurements were made on several days in summer and showed that in the afternoon and in the evening the temperature of the city exceeded the values of the country districts while the humidity decreased in them. For proving and comparing the measurements on the five places the records of five climatological stations of West Berlin were used. It was found that the influence of the city was more evident in the built-up areas of the town than on the climatological stations which are surrounded by gardens and parks.
Author (ESRO)

N70-27713 National Lending Library for Science and Technology, Boston Spa (England).
CALCULATION OF THE PROFILE OF LARGE WIND SPEEDS IN THE LOWEST 100 METRES OF THE ATMOSPHERE FROM SURFACE DATA
L. A. Kljuchnikova et al 28 Nov. 1969 17 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 226, 1968 p 98–106
(NLL-M-7936-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A theoretical model of atmospheric boundary layer structure was used in calculating the strong wind profiles. The expression for calculating the wind speed was obtained from the solution of the following set of equations: equations of motion, balance of turbulent energy, and transfer of heat and moisture in the air and ground. These equations were solved for static situations, for horizontally homogeneous air flow, and for nonadvective air flow. Individual cases of strong winds with uniform conditions and nonadvective air flow were chosen from observational data at different meteorological stations.
J.M.C.

N70-27742# National Lending Library for Science and Technology, Boston Spa (England).
THE DIURNAL VARIATION OF AIR HUMIDITY IN DIFFERENT REGIONS OF THE USSR IN THE WARM HALF OF THE YEAR
A. A. Bacurina et al 28 Nov. 1969 10 p refs Transl. into ENGLISH from Gidromet. Nauc. Issled. Cent. (SSSR), v. 27, 1968 p 16–24
(NLL-M-7958-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

Humidity data are analyzed taking into account cloud cover, soil conditions, boundary layer of the atmosphere, and synoptic conditions. Three types of diurnal variation were determined. Type 1 with two maxima (morning and evening) and two minima; Type 2 with one minimum at night and one maximum during the day; and Type 3 with small fluctuations. Type 1 occurs most frequently during the summer months when the soil is dry and the weather is mostly clear. Types 2 and 3 occur more often during spring and fall when he soil is moist and precipitation is falling.
N.E.N.

N70-27762# Freiburg Univ. (West Germany).
SFERICS COINCIDENCE MEASUREMENTS IN THE FIELD WITH NARROW-BAND RECEIVERS [SFERICS-KOINZIDENZMESSUNGEN IM SELAENDE MIT SCHMALBANDEMPFAENGERN]
W. R. Ranscht-Froemsdorff and H. Weise *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 73–79 refs In GERMAN; ENGLISH summary (See N70-27752 13-13)
Avail: CFSTI

A method of measuring coincidences by means of equal portable narrow-band receivers for the 10 and 100 kHz regions is reported. Sferics show characteristic variations with regard to the weather, orography and ground conditions. In the earth-ionosphere cavity long distance impulses lose their low and high frequencies (band-pass) and are even more reduced by mountains in the shorter wave regions (low-pass). Weather highs moving eastwards sometimes show a waveguide effect in which the frequency spectrum changes towards the 100 kHz regions (high-pass). When comparing the pulse recurrence frequency of both measured bands

a model relation can be used which yields information about the grade of the tropospheric instability and could lead to more accurate weather forecasts. Author (ESRO)

N70-27771# Weather Wing (2nd), APO 332, New York.
THE IMPORTANCE OF THE IONOSPHERE FROM A METEOROLOGICAL POINT OF VIEW [DIE BEDEUTUNG DER IONOSPHAERE AUS METEOROLOGISCHER SICHT]
Willi Laun *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 135 139 In GERMAN; ENGLISH summary
(See N70-27752 13-13)
Avail: CFSTI

A relationship is suggested between pressure distribution and occurrences in the ionosphere. Although this construction is of speculative nature it is based on meteorological results showing features which point to an extraterrestrial influence. When such a relationship exists it should be based on electromagnetic fields, and in this case the ionosphere should play an essential role. For solving these problems intensive research will be necessary, including the installation of an extended ionospheric network. Author (ESRO)

N70-27797 National Lending Library for Science and Technology, Boston Spa (England).
ON THE PROBLEM OF THE RATIONAL PLANNING OF A NETWORK FOR MAKING AIR TEMPERATURE OBSERVATIONS
L. S. Gandin et al 28 Nov. 1969 13 p refs Transl. into ENGLISH from Glav. Geof. Obs. (Leningrad), v. 228, 1968 p 30–40
(NLL-M-7959-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The network density requirement for daily mean air temperatures was considered. Computer analysis of temperature field statistics enabled a more accurate evaluation of daily mean air temperatures. The homogeneity and isotropy hypothesis or surface temperature fields were examined and found to be invalid for the covariance function, but satisfied the correlation coefficient function. Correlation functions were approximated for several regions in Europe and Asia. S.S.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N70-26639# National Aviation Facilities Experimental Center, Atlantic City, N.J.
AN EVALUATION OF THE VECTOR ANALOG COMPUTER, MODEL 5A, AREA NAVIGATION EQUIPMENT Final Report, Mar. 1967 Apr. 1970
John J. Wojciechowicz and Robert J. Mc Fadden May 1970 97 p
(FAA-RD-70-11; FAA-NA-70-8) Avail: CFSTI

Laboratory and flight tests were conducted on a Vector Analog Computer, Model 5A, Area Navigation Equipment. Based on the test results, it was concluded that: (1) The area navigation equipment input bearing processor minimizes the effect of certain VOR and TACAN azimuth signal perturbations. A bearing lag is introduced, however, that is proportional to the aircraft radial crossing rate; (2) The area navigation equipment permits navigation with accuracies generally equal to or better than those provided by conventional navigation equipment; (3) The area navigation equipment permits locating an airport within line-of-sight distances of the guidance VORTAC and, under certain conditions, completing straight-in approaches to non-instrumented runways; (4) Linear display of lateral deviation, with appropriate scale sensitivities, is generally more desirable than an angular display of deviation, especially at longer ranges. Author

N70-26791# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ASTRONOMICAL NAVIGATION OF AERODYNAMIC AND SPACE VEHICLES
L. M. Vorobev 31 Oct. 1969 387 p refs Transl. into ENGLISH from the Russian
(AD-700599; FTD-MT-24-186-69) Avail: CFSTI CSCL 17/7

The book presents the foundation and analysis of methods of application of contemporary means of astronavigation, determination of their accuracy characteristics and effectiveness. It examines the system of spherical celestial coordinates of luminaries, conditions and possible principles of their direction finding. A general equation for direction finding of a luminary by a plane from a mobile platform is obtained along with equations of direction finding of a luminary from aerodynamic and space vehicles. The cause and character of changes of coordinates of luminaries in flight are examined; a survey of systems of measurement of time used during solution of problems of navigation of aircraft is given, and astronomical methods of measurement of time are shown. A foundation for a rational method of in-flight application of aviation sextants and automatic astrocompasses is given. Possible principles of use of astronomical methods in automated complex navigational systems are examined. In an example of stellar tracker type BTs-63 the method of preparation of initial data is expounded. Means and methods of calculation and appraisal of conditions of natural illumination in flight are shown. TAB

N70-26841# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THE DODGE ATTITUDE DETERMINATION SYSTEM Technical Memorandum
R. L. Hickerson Oct. 1969 95 p refs
(Contract NOW-62-0604-C)
(AD-700660; APL-TG-1091) Avail: CFSTI CSCL 22/1

The report describes the DODGE satellite attitude sensors, their function, and the method of determining the satellite attitude from sensor output. TAB

N70-27118*# Bellcomm, Inc., Washington, D.C.
PROBLEMS IN ATTITUDE CONTROL OF ARTIFICIAL G SPACE STATIONS WITH MASS UNBALANCE
R. A. Wenglarz 23 Dec. 1969 36 p refs
(Contract NASw-417)
(NASA-CR-109828; TM-69-1022-12) Avail: CFSTI CSCL 17G

It is shown that there exist coning motions of the satellite with amplitudes that can be minimized by several design considerations. Design should be such that the axial moment of inertia of the spinning section is as much as possible greater than the transverse moment of inertia of the space station. This implies that the despun section is much smaller than the spinning section and that the space station presents a low, flat silhouette when viewed from a direction normal to the spin axis. Also, crew compartments and compartments to and from which equipment is to be shifted should be situated as close as possible to the space station mass center. In addition, for very large satellites, it is found impractical to use control moment gyros (CMGs), even with implementation of these design features, to reduce the coning motion amplitudes to within allowable limits for many experiments which will be carried in future space stations. To alleviate the mass unbalance problem, a means of facilitating an active mass balance system which has been suggested by NASA is discussed and a lighter, simpler, passive system is proposed for further study. Author

N70-27126*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN EVALUATION OF TWO GUIDANCE SCHEMES FOR A MANNED LUNAR LANDING

George J. Hurt, Jr., Hugh P. Bergeron, and James J. Adams Washington May 1970 45 p refs

(NASA-TN-D-5817; L-6761) Avail: CFSTI CSCL 17G

A fixed-base simulation of a lunar descent was performed. The simulation, using instruments only, was conducted to compare two vehicle attitude programs: a single pitch-angle change and a multiple pitch-angle change. The comparison was made to determine a pilot's ability to complete a lunar descent from a 50,000-foot (15,240 meters) circular orbit to a hover altitude of approximately 1000 feet (305 meters) after a malfunction had forced the pilot to take control. System failures which would have caused a disaster if the pilot had not assumed control were randomly introduced during the simulated descents. Either of the two letdown profiles could be handled by the pilots. The multiple pitch-angle profile appeared to afford the pilot greater chance for success than did the single pitch-angle profile. Author

N70-27196# European Space Research and Technology Center, Noordwijk (Netherlands).

PERFORMANCE OF A COLD-GAS JET AT SHORT PULSE LENGTHS. CALCULATION OF THE MINIMUM PULSE RATE AND MEASUREMENT OF THE SPECIFIC IMPULSE FOR PULSES SHORTER THAN 20MS

A. H. Pfeffer Aug. 1969 52 p refs

(ESRO-TN-95-ESTEC) Avail: CFSTI

Mass-ejection devices are a means of stabilising a synchronous satellite and usually take the form of gas jets. A method has now been devised by which an analog computer can be used to determine the gas jet pulse rate as a function of the impulse per pulse during limit cycling in the presence of a variable disturbance torque. Results show that there is a pulse length yielding a minimum pulse rate and that it is within the capabilities of solenoid valves now available. As no experimental results on the specific impulses of very short pulses were on hand, a test facility was built for measuring the specific impulses associated with gas-jet pulses shorter than 20 ms. It has been found that a well-designed valve-nozzle unit still yields the steady-state specific impulse at a pulse length of 10 ms and that the losses do not exceed 10% at an open time of 3 ms. The gas used was nitrogen at ambient temperature. The smallest gas pressure was 1 bar. Author (ESRO)

N70-27300# Advisory Group for Aerospace Research and Development, Paris (France).

GUIDANCE AND CONTROL FOR AEROSPACE VEHICLES Lecture Series

Frank M. Brown (US Air Force Inst. of Tech.), Roger W. Johnson, and Donald O. Norris (US Air Force Inst. of Tech.) June 1969 214 p refs

(AD-688334; AGARDOGRAPH-131) Avail: CFSTI

The application of modern control theory to the generation of guidance laws for astronautical as well as atmospheric aerospace vehicles is analyzed. Time domain analysis and frequency domain considerations are implemented in determining instrumentation response characteristics. Particular emphasis is placed on the use of digital computers in solving these highly nonlinear problems, and techniques are demonstrated for implementing and mechanizing these solutions to airborne and astronautical vehicles. The concepts of input-output, state space representations, and matrix analysis are coupled to a discussion of solutions of state space equations and the calculation of state transition matrices for linear systems. Optimization theory is utilized for formulations and algorithms to generate optimal controllers for fixed time two point boundary value problems. The theory of inertial sensors is presented as well as their implementation into stable platforms operating both in inertially fixed and local vertical tracking modes. The concept of influence coefficients, involving trajectory theory and perturbation analysis, is used to derive the multipliers of errors generated by the guidance system. D.L.G.

N70-27310*# Boeing Co., Seattle, Wash. Aerospace Systems Div.

LUNAR ORBITER PROGRAM GUIDANCE AND CONTROL SYSTEM: DESIGN SURVEY. NASA/ERC DESIGN CRITERIA PROGRAM: GUIDANCE AND CONTROL

9 May 1969 215 p refs

(Contract NAS12-2027)

(NASA-CR-86372; D2-114277-3) Avail: CFSTI CSCL 17G

This design survey presents the results of an eight month study of the Lunar Orbiter Guidance and Control system and program documentation. Highlights of the experiences gained from program initiation through the final terminal crash maneuver of Lunar Orbiter vehicle are reported. The things of value to the designer of future spacecraft are emphasized. The evolution of the design was studied and the reasons for changes have been indicated. Considerable effort was made to identify and report the cause for difficulties that occurred. Reasons for success as well as failure are summarized beginning with the total spacecraft program; proceeding to an in-depth review of the guidance and control system, its subsystems, and finally guidance and control components. Author

N70-27368# Siemens A.G., Munich (West Germany). Zentral-Lab. fuer Nachrichtentechnik.

LAYOUT AND PERFORMANCE OF A RADIOGONIOMETER [AUFBAU UND LEISTUNGSFAEHIGKEIT EINES RADIOGONIOMETERS]

M. Schoenfeld Feb. 1970 77 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.

(BMBW-FB-W-70-07) Avail: CFSTI

Recently the use of radio-sensors instead of earth-, sun- and star-sensors for attitude determination of satellites has been considered. This study contains some fundamental considerations based on already existing proposals for 3-axis-stabilized synchronous satellites. Some possibilities for the realization of a 2-axis-angle-measurement are theoretically examined, including an investigation of possible error sources. A comparison with a very advanced infrared-sensor shows that in some cases the use of a radiogoniometer is advantageous. At present a proposal of the optimum method is not yet possible. In particular, further considerations about 3-axis-measurements and supplementary experimental work will be necessary. Author (ESRO)

N70-27388# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.

AN INVESTIGATION OF THE ERROR FIELDS OF STATIONARY NAVIGATION SATELLITES [UNTERSUCHUNGEN UEBER FEHLERFELDER VON STATIONAEREN NAVIGATIONSSATELLITEN]

Otto Weber Nov. 1969 60 p refs In GERMAN; ENGLISH summary

(DLR-FB-69-95) Avail: CFSTI

The paper deals with the analysis and representation of the random errors of those navigation systems which combine range measurements to several synchronous satellites with a flight altitude measurement. Preliminary results can be derived from the mean errors of the measurements and the gradients of the navigation system but more refined investigations must use multi-dimensional normally distributed error vectors, their error ellipsoids and their projections on suitable reference planes and lines. When the navigation system is geometrically and statistically symmetrical for particular planes, the error trajectories method

developed for two dimensional systems can be applied to three dimensional problems. The treatment of the singular areas of errors fields is discussed in detail. Two error models with different altitude measurement errors were analysed for a navigation system consisting of two synchronous satellites and the influence of the altitude measurement error on the horizontal and vertical separation of aircraft is indicated on a Mercator representation. The analysis of navigation systems, with more general assumptions, is also considered. Author (ESRO)

N70-27448 Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
CONTRIBUTION TO THE THEORY OF THE GYROSCOPIC VERTICAL FOR AIRCRAFT [CONTRIBUTION A LA THEORIE DE LA VERTICALE GYROSCOPIQUE POUR AVIONS]
R. G. Pinelle [1969] 20 p refs Transl. into FRENCH from Vestn. Mosk. Univ., no. 1, 1969 p 117–125
Avail: Issuing Activity

The problem of the limitation and damping of ballistic deviations in aviation vertical reference gyroscopes was studied, taking into account the vertical motion of the aircraft, and correction was introduced into the device circuit. ESRO

N70-27449 Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
ERROR ACCUMULATION IN INERTIAL NAVIGATION SYSTEMS [ACCUMULATION DES ERREURS DANS LES SYSTEMES DE NAVIGATION INERTIELLE]
E. I. Siv et al [1969] 11 p refs Transl. into FRENCH from Izv. Vyschikh Uchebn. Zavedenii Priboreor., no. 5, 1969 p 77-80
Avail: Issuing Activity

The accumulation of errors in the determination of the position of a vehicle by an inertial reference system was studied. The drift rate was conditioned by the fact that the input axis of the accelerometers was sensible to orthogonal forces. A matrix method was used to integrate the differential equations. ESRO

N70-27506 France. Ministere de l'Air, Paris. Centre de Documentation de l'Armement.
THE ATTITUDE CONTROL SYSTEM FOR THE VENUS INTERPLANETARY PROBE [LE SYSTEME DE PILOTAGE DE LA SONDE INTERPLANETAIRE 'VENUS']
B. V. Raouchenbakh [1969] 24 p refs Transl. into FRENCH from Kosmich. Issled (Moscow), v. 6, no. 4, 1968 p 551–560
In FRENCH and RUSSIAN
Copyright. Avail: Issuing Activity

The attitude control and trajectory correction system used on the Soviet interplanetary probe Venus are described. Diagrams are given and the principles of the system are described. ESRO

N70-27857 France. Ministere de l'Air, Paris. Centre de Documentation de l'Armement.
DETERMINATION OF THE ATTITUDE OF A SPACE VEHICLE FROM STAR PHOTOGRAPHS [DETERMINATION DE L'ORIENTATION DES ENGINS SPATIAUX D'APRES DES PHOTO D'ETOILES]
I. A. L. Zimen et al Jan. 1970 21 p refs Transl. into FRENCH from Kosmich. Issled. (Moscow), v. 7, no. 2, 1969 In FRENCH and RUSSIAN p 291–295
(Trans-0266) Copyright. Avail: Issuing Activity

A method for measuring the attitude of a space vehicle using star photographs taken by an outboard camera having a known orientation with respect to the geometric axis of the vehicle is described. The solution of the problem involves four rectangular coordinate systems: one equatorial, one horizontal, one linked to the vehicle, and one linked to the photograph. ESRO

N70-27885# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
PASSIVE MAGNETIC ATTITUDE CONTROL OF EARTH SATELLITES [PASSIV MAGNETISCHE LAGEREGELUNG VON ERDSATELLITEN]
H. Forehlich, F. Meech, G. Schweizer, and K. Stopfkuchen Feb. 1970 331 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-70-05) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 69, 10 DM

This report is concerned with the dynamic behaviour of earth satellites with passive magnetic attitude control. A mathematical model of the dynamic system is presented and a treatise on linear transfer systems with periodic coefficients is given. A procedure for solving the system equations yields a set of linear algebraic equations with complex coefficients, which can be solved easily by means of well known numeric procedures. Some solutions for the German satellite AZUR are added as numerical examples. The satellite's behavior during the acquisition phase can be predicted only by means of numerical integration of the highly nonlinear systems equations. Some basic considerations as to the suitability of existing numeric integration procedures for simulation are given. The design of the magnetic elements of the stabilization system is treated and special attention is paid to the question of the optimal shape of the permanent magnets and the optimal configuration of the damping system. Author (ESRO)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N70-28522# Atomics International, Canoga Park, Calif.
CORROSION OF TYPE 316 STAINLESS STEEL WITH SURFACE HEAT FLUX IN 1200 F FLOWING SODIUM
J. Hopenfeld 30 Nov. 1969 32 p refs
(Contract AT(04-3)-701)
(AI-AEC-12898) Avail: CFSTI

In a sodium cooled reactor, the surface temperature of the cladding and the bulk liquid temperature increase along the channel, as a result of heat generation in the fuel. The difference between the solubility of the corrosion products at the local surface temperature and the corresponding concentration of the corrosion products in the bulk of the sodium provides the driving force for cladding corrosion. The ability to predict this corrosion rate is a prerequisite for proper cladding design and system maintenance. A method is provided for estimating the corrosion rate of the cladding when the sodium at the entrance to the fuel channel has an oxygen content less than 5 ppM and is saturated with respect to the corrosion products. The predictions are based on experimental data of local corrosion rates, which were measured along a 3.5-in. sectional cladding sample. Dissert. Abstr.

N70-28626# Syracuse Univ., N.Y. Dept. of Chemical Engineering and Metallurgy.
SEPARATION OF KRYPTON AND XENON FROM REACTOR ATMOSPHERES BY SELECTIVE PERMEATION Progress Report, 1 Jan. – 31 Dec. 1969
S. A. Stern 31 Dec. 1969 33 p refs
(Contract AT(30-1)-4057)
(NYO-4057-1) Avail: CFSTI

Studies are being made to develop an efficient process for removing rare gas fission products from nuclear reactor

atmospheres by selective permeation through nonporous polymeric membranes. The potential value of anisotropic (cellulose acetate) membranes for the removal of Kr and Xe fission products is being investigated. NSA

N70-28628# Oak Ridge National Lab., Tenn.
AN EVALUATION OF THE MOLTEN-SALT REACTOR EXPERIMENTS HASTELLOY N SURVEILLANCE SPECIMENS: THIRD GROUP
H. E. McCoy, Jr. Jan. 1970 88 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2647) Avail: CFSTI

Studies were made on the third group of Hastelloy N surveillance samples removed from the Molten-Salt Reactor Experiment. Standard Hastelloy N was removed from the core after exposure to a thermal fluence of 9.4 × 10 to the 20th power neutrons/sq cm over a time period of 15,289 hr at 650 C and from outside the reactor vessel after exposure to a thermal fluence of 2.6 × 10 to the 19th power neutrons/sq cm over a time period of 20,789 hr at 650 C. The former samples were exposed to the fuel salt and the later samples were exposed to nitrogen plus 2 to 5% O2. The material seemed quite compatible with both environments. Postirradiation tests showed that the fracture strain was reduced at 25 C and above 500 C. The reduction in ductility at 25 C is likely due to carbide precipitation and the reduction above 500 C is due to the presence of helium from the B-10(N, alpha)Li-7 transmutation. The accumulated results in this series of experiments allow us to follow the changes in fracture strain over the thermal fluence. NSA

N70-28644# European Atomic Energy Community, Karlsruhe (West Germany). Joint Nuclear Research Center.
CERAMOGRAPHY OF AMERICIUM OXIDES
C. Sari, V. Tebaldi and I. Della Pietra Brussels 1970 16 p refs
(EUR-4413.E) Avail: CFSTI

The procedure, the apparatus and the etching conditions used for the ceramographic analysis of americium oxides are reported. The results of microhardness measurements are given. A tentative americium-oxygen diagram was drawn. Author

N70-28662# Oak Ridge National Lab., Tenn.
THORIUM FUEL CYCLE DEVELOPMENT Progress Report Ending 5 Dec. 1969
Jan. 1970 16 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2792) Avail: CFSTI

Research and development are reported on head-end reprocessing, refabrication, materials irradiation, and U-233 reprocessing. NSA

N70-28665# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
Ni-BASE ALLOY FUEL DISPERSIONS
F. C. Robertshaw 19 Dec. 1969 34 p refs
(Contract AT(40-1)-2847)
(GEMP-717) Avail: CFSTI

Properties of plate-type fuel elements prepared by powder metallurgy using UO2 in a matrix of 80 Ni - 20 Cr were examined. Cladding for such elements composed of 80 Ni-20 Cr alloy is discussed along with braze alloys composed of 20 Cr - 10 Si - Ni for sealing. Data are included on radiation effects and tensile tests. NSA

N70-28684# Oak Ridge National Lab., Tenn.
HEAVY-SECTION STEEL TECHNOLOGY PROGRAM Semiannual Progress Report for Period Ending 29 Feb. 1969
Jan. 1970 198 p refs
(Contract W-7405-eng-26)
(ORNL-4463) Avail: CFSTI

The program for assessing the structural safety of present and contemplated water-cooled reactor pressure vessels is investigated and the agencies responsible for the investigations are discussed. Inspection, characterization, variability determinations, transition temperature investigations, fracture mechanics studies, and fatigue-crack propagation tests are discussed for unirradiated materials. Simulated service tests and stress analysis are considered for predicting the fracture behavior of reactor pressure vessels. Data on the effects of specimen thickness, strain rate, and temperature on fracture toughness are given. Fracture toughness and temperature shifts are discussed for irradiated materials. NSA

N70-28687# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Fuel Div.
SAXTON PLUTONIUM PROJECT. Quarterly Progress Letter, Period Ending 30 Sep. 1969
W. R. Smalley Nov. 1969 11 p refs
(Contract AT(30-1)-3385)
(WCAP-3385-21) Avail: CFSTI

Fast neutron radiation effects on mechanical properties of Core 2 fuel rods are analyzed. Physics measurements for Core 3 are described. NSA

N70-28693# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
FERRITIC STAINLESS STEEL FUEL DISPERSIONS
F. C. Robertshaw 5 Dec. 1969 20 p refs
(Contract AT(40-1)-2847)
(GEMP-718) Avail: CFSTI

Properties of fuel elements composed of UO2 dispersed in ferritic stainless steel are tabulated and discussed. Cladding variations for these elements including stainless steel, and Fe-base-30 Cr - 1 Y alloys are examined. Data and micrographs are included. NSA

N70-28908# Max-Planck-Institut für Metallforschung, Stuttgart (West Germany).
FABRICATION OF POROUS COMPACTS OF URANIUM MONOPHOSPHIDE
G. Moench Nov. 1969 48 p refs In GERMAN
(BMWF-FBK(K)-69-41) Avail: AEC Depository Libraries

A method for the production of uranium monophosphide (UP) from its elements is described. The reaction product contained less than 0.3 weight % oxygen and was characterized with respect to composition, surface properties, particle size, and powder density as well as milling and pressing behavior. The sintering processes in high vacuum were investigated by measurements of density, weight losses, specific surfaces and by the determination of tapological parameters. From the results three temperature dependent material transport mechanisms could be deduced. The process of fission gas removed by diffusion in porous reactor materials is discussed. The condition for the stationary state between formation and removal of fission gases during radiation is deduced. Author (NSA)

N70-28920# Gulf General Atomic, San Diego, Calif.
PERFORMANCE OF THERMIONIC REACTORS FOR 20 TO 100 kWe
W. G. Homeyer Nov. 1969 13 p refs Presented at the 1969 Thermionic Conversion Specialist Conf., Carmel, Calif.
(Contract AT(04-3)-167)
(GA-9488; CONF-691024-1) Avail: CFSTI

Four types of thermionic reactors for the 20 to 100 kW(e) power range were studied. The characteristics of these reactors are described and performance estimates for power plants operating

them are given. All of the reactors contain the six-cell thermionic fuel elements which are presently under development. Two reactors contain only thermionic fuel elements in the core. One of them, fueled with U-235, is criticality limited, and has about twice as many thermionic cells as are necessary to produce 100 kW(e). With U-233, the minimum critical reactor is in the 50 to 100 kW(e) power range. Reactors fueled with U-235 containing UN and U–ZrH driver fuel elements in addition to thermionic elements were also studied. All-cell reactors fueled with U-233 were shown to produce the lightest power plants in the 50 to 100 kW(e) power range. At 100 kW(e), power plants containing the U-235 all-cell reactor, the UN driver reactor, or the U–ZrH driver reactor are all comparable in weight. Author (NSA)

N70-26621# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
ON SITE HANDLING STUDY FOR THE LOW CAPACITY SODIUM PUMP
John Wasko 25 Apr. 1969 44 p refs
(Contract AT(30-1)-3762)
(WARD-3762-10) Avail: CFSTI

A discussion of the on-site handling requirements for a liquid-sodium coolant-system pump is presented. It is intended to serve as a reference manual and aid in designing both the FFTF pump and the physical plant and plant facilities in which the pump would be operated. A method, with associated equipment definitions, for performing major maintenance on the removable pump internals is described. 6 references. Author (NSA)

N70-26626# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
COMPRESSIVE CREEP CHARACTERISTICS OF STOICHIOMETRIC URANIUM DIOXIDE
P. E. Bohaboy, R. R. Asamoto, and A. E. Conti May 1969 52 p refs
(Contract AT(04-3)-189)
(GEAP-10054) Avail: CFSTI

The creep of cold-pressed and sintered stoichiometric uranium dioxide was measured in compression as a function of temperature, stress, grain size, and theoretical density. The creep rate of uranium dioxide as a function of these parameters is described by a modified Arrhenius equation. The strain rate of uranium dioxide was found to be inversely proportional to the square of the grain size at low stresses and inversely related to the density. The experimental results fit the modified Arrhenius equation with + or – 32% at a confidence level of 90%. This type of behavior of uranium dioxide is in agreement with existing theoretical descriptions of creep mechanisms, and the correlation indicates that thermally activated creep in uranium dioxide results from a combination of stress-enhanced diffusion, dislocation motion, and sliding at grain boundaries. The mechanism which dominates and controls the creep rate is dependent on the specific temperature, stress, grain size, and density. Activation energies for uranium dioxide creep were calculated to be 90 kcal/mole in the low stress regions and 132 kcal/mole in the high stress regions. Data previously reported on the creep of uranium dioxide agreed well with the results of this investigation. The effects of density and grain size on the creep behavior of uranium dioxide were evaluated and the relations of these material parameters to nuclear fuel element design were discussed. Author (NSA)

N70-26627# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
MELTING POINT OF PLUTONIA-URANIA MIXED OXIDES IRRADIATED TO HIGH BURNUP
J. L. Krankota and C. N. Craig Jul. 1969 52 p refs
(Contract AT(04-3)-189)
(GEAP-13515) Avail: CFSTI

The melting points of stoichiometric and hypostoichiometric mixed oxides fuels irradiated to burnups up to 200,000 MWd/te were measured using a tungsten V-filament furnace in an atmosphere of helium under 10 psig pressure. The melting point of plutonia-urania mixed oxides was observed to decrease approximately 80 C at 200,000 MWd/te. The melting point decreased negligbly at 80,000 MWd/te. Author (NSA)

N70-26628# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
IRRADIATION TESTING AND EVALUATION OF REFRACTORY METAL FUEL ELEMENTS OF 710 FAST REACTOR PROGRAM Final Report
D. L. Newsom and J. F. Collins Oct. 1969 41 p refs
(Contract AT(40-1)-2847)
(GEMP-710) Avail: CFSTI

The fuel burnup capability was determined for eighteen refractory-metal clad W–UO2 cermet fuel specimens irradiated under long-time service conditions characteristic of Brayton Cycle Reactor Systems. Three experiments initiated by the 710 Reactor Systems Program were tested in the Low Intensity Test Reactor for times to 13,400 hours at temperatures to 1535 C. These experiments demonstrated that high density W-alloy-clad W-60UO2 fuel specimens, fully bonded and not vented, have good dimensional stability and containment of fission products to temperature levels of 1440 C. Efforts to extend the leak-free life and dimensional stability of the fuel specimens by the addition of rhenium to the matrix were not only ineffective but detrimental. Performance capabilities exceeding those required for the 710 Reactor application were demonstrated by these inpile experiments. Furthermore, the results of these tests indicate the W–UO2 fuel element should be considered for other applications such as lithium- and potassium-cooled SNAP systems, and fast thermionic direct conversion power plants. Author (NSA)

N70-26635# Scientific Research Atomic Reactor Inst., Melekess (USSR).
ON THE QUESTION OF THE DISTRIBUTION OF FISSION FRAGMENTS IN A LATTICE OF URANIUM DIOXIDE [K VOPPOSY RASPREDELENIYA OSKOLKOV DELENIYA V RESHETKE DVUOKISI URANA]
V. P. Vyskubov and I. G. Pebedev 1968 14 p refs In RUSSIAN
(SRARI-P-29) Avail: AEC Depository Libraries

UO2 crystal lattice states after the high temperature irradiation to burnup of 9 at. % U were investigated by X-ray analysis. The structural factor values have been calculated in relative units and the relationships have been plotted in terms of sine curves. It is proved from the mutual curves position that the fission fragments occupy the octahedral pores of UO2 lattice. The supposition has been made that the observed UO2 lattice period decrease is associated with both the fission fragment accumulation in it and additional oxidation. Author (NSA)

N70-26643# Oak Ridge National Lab., Tenn.
THORIUM FUEL CYCLE DEVELOPMENT Progress Report, Period Ending Jan. 1970
Jan. 1970 20 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2846) Avail: CFSTI

Research and development are reported on head-end reprocessing, refabrication, materials irradiation, and U-233 reprocessing. NSA

N70-26644# Oak Ridge National Lab., Tenn.
EFFECT OF CONTAINMENT SPRAY SOLUTION ON TRAPPING OF RADIOACTIVE METHYL IODIDE FROM FLOWING STEAM-AIR BY IODIZED CHARCOAL: WESTINGHOUSE TEST SERIES

R. D. Ackley and R. E. Adams Jan. 1970 27 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2805) Avail: CFSTI

The effect of applying containment spray solution to iodized charcoal on its capability for decontaminating radioactive methyl iodide transported in flowing steam-air has been investigated in a series of five tests. Approximate conditions for each decontamination test included 130 C (266 F), 55 psia, steam-air face velocity of 40 fpm, 6 mg CH3I/cubic meter injected for 1.5 hr, and a calculated average relative humidity near 100%. All five tests were on one type of iodized charcoal, and all were for the case of downward flow. The aqueous spray solution contained 2000 ppM B, on a weight basis, added as Na2B4O7. Comperison of results with previous results indicated that the introduction of spray to the extent of 20 wt % by either manner of application caused relatively unimportant losses in decontamination capability, and the indicated loss associated with the test where 40 wt % pertained was moderately larger. Author (NSA)

N70-26653# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
GROUP CONSTANTS FOR ANALYSIS OF FFTF CRITICAL EXPERIMENTS
J. V. Nelson and S. L. De Myer Nov. 1969 24 p refs
(Contract AT(45-1)-1830)
(BNWL-1044) Avail: CFSTI

Nuclear data and multigroup constants are listed which have been available for the analysis of FFTF critical experiments. In general, the cross section data are identical to the 26 group Russian set with the exception that some group constants, for several isotopes, have been modified. Only the data which differ from those previously compiled are included. Author (NSA)

N70-26654# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
SYSTEM EFFECTIVENESS GOALS FOR THE FAST FLUX TEST FACILITY
R. A. Harvey, S. S. Hintze, H. C. Martin, M. A. Mc Laughlin, and O. B. Monteith Nov. 1969 34 p refs
(Contract AT(45-1)-1830)
(BNWL-791) Avail: CFSTI

The Fast Flux Test Facility (FFTF) is an experimental facility intended for use in developing the technology for efficient electric power generation from nuclear energy. An effective design for the FFTF must allow for equipment random malfunctions in order to achieve high system availability for its intended use. System effectiveness goals are presented, and a reliability program aimed at achieving high plant effectiveness is described. The goals are intended for the guidance of subsystem designers. The reliability program indicates the types of analyses and documentation recommended by the authors. Author (NSA)

N70-26657# Gulf General Atomic, San Diego, Calif.
TUBE SUPPORT DAMPING FORT ST. VRAIN STEAM GENERATOR
W. Kellar 15 Nov. 1969 26 p refs
(Contract AT(04-3)-633)
(GAMP-9735) Avail: CFSTI

The damping data presented were obtained from a representative structure but many important factors were not considered. The GAVEL wedge test data match effects of air density and temperature, but do not include frequency effects. Fort St. Vrain sleeve/wedge test data do not include helium density, temperature, or frequency effects. The GAVEL wedge data are intentionally biased to the lower magnification factor values. Application of these values produces conservatively high lift coefficients. Similarly, the Fort St. Vrain sleeve/wedge data are based on the higher magnification factor from in-plane preloading, which gives conservatively high stresses and deflections. Conservative values of Fort St. Vrain magnification factor have been determined for the GAVEL wedge and the Fort St. Vrain sleeve/wedge. Author (NSA)

N70-26660# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
THE USE OF SPECTRUM AVERAGED CROSS SECTIONS IN THE CALCULATION OF HELIUM GENERATED IN STAINLESS STEEL DURING REACTOR IRRADIATION
J. F. Scherrer and J. Moteff Nov. 1969 23 p refs
(Contract AT(40-1)-28847)
(GEMP-721) Avail: CFSTI

The expected helium generation in Types 304 and 316 stainless steels from fast neutron irradiation at different positions in several reactors was calculated using spectrum averaged cross sections. Correction factors to the fission spectrum averaged cross sections were proposed but much more work is required especially in the experimental measurement of the more important elemental cross sections. NSA

N70-26661# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
REFLECTOR SAVINGS FOR URANYL NITRATE OF LOW ENRICHMENT
C. A. Rogers, R. C. Lloyd, S. R. Bierman, and E. D. Clayton Nov. 1969 31 p refs
(Contract AT(45-1)-1830)
(BNWL-1258) Avail: CFSTI

Reflector savings for 2.14 and 3.04 wt % U-235 enriched UO2(NO3)2 reflecting a cuboidal core of PuO2-polystyrene were experimentally determined and compared with calculations using the HFN and DTF codes. HFN-computed reflector savings curves for less than 5.0 wt % U-235 enriched UO2(NO3)2 reflecting a spherical, water-moderated, U rod lattice are presented with a discussion of the principal parameters which influence reflector savings. Author (NSA)

N70-26662# North Carolina State Univ., Raleigh. Dept. of Nuclear Engineering.
DIFFUSION OF GASES IN SOLIDS Annual Progress Report, 1 Nov. 1968 - 31 Oct. 1969
Thomas S. Elleman, Andres Sy Ong, and Luther D. Mears 1 Nov. 1969 59 p refs
(Contract AT(40-1)-3508)
(ORO-3508-5) Avail: CFSTI

The diffusion of Xe-133 in I-133 doped and fission recoil doped single crystals of KI and RbI was studied. The diffusion coefficients over the temperature range 150 to 500 C were satisfactorily represented and in good agreement with previously measured values for CsI. A change from rock salt (RbI and KI) to body centered cubic structures (CsI) in alkali halides therefore does not result in a pronounced change in rare gas diffusion behavior. Variations in the diffusion coefficients which resulted from clustering of rare gas atoms were detected in KI crystals at concentrations as low as 0.001 ppM. A comparison of all experimental results with several possible diffusion models indictaed that the model most consistent with all data involved the association of diffusing rare gas atoms with mobile defect clusters. Experiments to identify surface effects on the release of Xe-133 from fission recoil injected single crystals of CaF2 and CsI were carried out. It was observed that surface strains from mechanical polishing, surface evaporation, and surface chemical reactions could all produce anomalous gas release behavior. Author (NSA)

N70-26663# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
RESEARCH AT BATTELLE-NORTHWEST ON TRANSPORT PROCESSES IN OXIDE NUCLEAR FUEL

Oct. 1969 41 p refs
(Contract AT(45-1)-1830)
(BNWL-1202) Avail: CFSTI

Studies of transport in fuels to coordinate precision laboratory measurements with in-pile experiments are reported. Results are applied to fuel systems design and behavioral model development. Emphasis has been on mixed uranium-plutonium oxides with lesser efforts on UO2, mixed nitrides, and uranium oxycarbides. Thermal diffusivities for various fuel materials have been measured at temperatures to 1700 C. Results together with studies of associated thermodynamic properties, melting points, phase equilibria, electrical and thermoelectric properties, and materials synthesis methods, have been applied toward designing and interpreting a variety of irradiation experiments. Included are measurements of stoichiometry and fabrication method effects on in-pile heat transfer. Author (NSA)

N70-26714# Bettis Atomic Power Lab., Pittsburgh, Pa.
A PROCEDURE FOR CALCULATION OF STEADY-STATE TEMPERATURE IN ZIRCALOY-CLAD, BULK-OXIDE FUEL ELEMENTS USING THE FIGRO COMPUTER PROGRAM (LWBR DEVELOPMENT PROGRAM)
I. Goldberg Nov. 1969 54 p refs
(Contract AT-11-1-GEN-14)
(WAPD-TM-757) Avail: CFSTI

Procedures are specified for using the FIGRO computer program to calculate clad and fuel temperatures in Zircaloy-clad bulk-oxide fuel rods. Rod temperature distributions are calculated at specified depletions from input values of surface heat flux, coolant temperature and pressure, heat transer coeficients, temperature-dependent clad thermal conductivity, temperature-dependent and concentration-dependent gas thermal conductivity in the fuel-clad gap, and temperature-, depletion-, and porosity-dependent fuel thermal conductivity. Provision is made to account for temperature increases due to long time crud and corrosion film buildup and steam properties are utilized to compute gap conductance in a defected fuel element. Gap dimensions are adjusted to account for differential thermal expansion and fuel swelling. All major assumptions and analytical procedures are identified. Material property inputs are specified on both a best estimate and design (worst-case) basis. These procedures were developed as part of the LWBR development program. Author (NSA)

N70-26734# Argonne National Lab., Ill.
SURVEILLANCE OF EBR-2 BLANKET SUBASSEMBLIES
V. G. Eschen Sep. 1969 31 p refs
(Contract W-31-109-eng-38)
(ANL-7597) Avail: CFSTI

Examinations performed on unalloyed, depleted-uranium blanket elements from EBR-II are presented. The criteria used in arriving at the present burnup limit of 0.27 at.% (max) are discussed and shown to be conservatively established. Swelling rates were investigated by calculating R values (ratios of swelling percentage to burnup percentage); the minimum and maximum values of R calculated for the points of highest burnup were 63 and 148. A maximum cladding strain of 0.9% was indicated at 0.27 at.% (max) burnup. Specific recommendations are presented for more fully evaluating the irradiation behavior and improving the performance of the blanket elements. A program to evaluate the feasibility of increasing the burnup limit of the present blanket material is proposed. Author (NSA)

N70-26735# Argonne National Lab., Ill.
ANALYSIS OF THE LINEAR COMPONENTS OF THE POWER-REACTIVITY DECREMENT (PRD) IN EBR-2
John T. Madell and Richard E. Jarka Oct. 1969 32 p refs
(Contract W-31-109-eng-38)
(ANL-7539) Avail: CFSTI

The linear components of the power-reactivity decrement (PRD) are described. Their representation for the neutronic calculations is analyzed. The computer processing of the input specifications for the PRD calculations of six loadings of EBR-II is explained, and the results of the calculations are presented. The results indicate that the linear components of the PRD are of the same magnitude for the six loadings. However, small trends in some linear components are observed with changes in core size and substitution of materials in the inner-blanket region. The analytical results compare favorably with the results of the limited amount of experimental data available. The experimental data and recent analytical work suggest that a higher value of the linear-expansion coefficient of the fuel should be used in the PRD calculations. Results of an investigation of partial loss of fuel expansion coefficient and slumping of fuel are presented. Author (NSA)

N70-26750# Oak Ridge National Lab., Tenn.
AN ESTIMATE OF THE ENHANCEMENT OF FISSION PRODUCT RELEASE FROM MOLTEN FUEL BY THERMALLY INDUCED INTERNAL CIRCULATION
M. H. Fontana Dec. 1969 31 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2448) Avail: CFSTI

An approximate evaluation is presented of diffusion and internal convection as mass transfer mechanisms under fairly quiescent conditions. This condition was chosen because it would result in larger amounts of heat generating fission products remaining in the melt than would be the case with more violent agitation. Internal heat generation in a molten slab of fluid cooled primarily from the upper surface would create a temperature gradient which, at some critical value, would cause internal convection currents due to the greater buoyancy of the hotter material in the lower portions of the melt. These convection currents enhance both the heat and mass transfer from the interior of the molten material to the surface. The heat transfer and rate of release of fission products from a slab of molten fuel and steel were calculated and the results compared with a diffusion calculation. A sensitivity analysis was performed and the effects of wide variations in the thickness of the melt, viscosity, coefficient of thermal expansion, diffusion coefficient, specific heat, and thermal conductivity are presented. Author (NSA)

N70-26774# Los Alamos Scientific Lab., N. Mex.
ULTRA HIGH TEMPERATURE REACTOR EXPERIMENT (UHTREX) Quarterly Status Report, Period Ending 31 October 1969
12 Dec. 1969 12 p refs
(Contract W-7405-eng-36)
(LA-4330) Avail: CFSTI

Progress is reported on operation of the reactor, fuel elements, and analysis of gas samples from the reactor core. Improvement of supporting equipment such as orifice plates in the primary loop, the fan speed control system, gamma spectroscopy system, and the gas and core sampling systems are reported. Reactor physics and engineering research and development are summarized. NSA

N70-26776# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
CORRELATION OF THE ACTIVITY OF THE REACTOR COOLANT WITH APPARENT ABSENCE OF A FUEL ELEMENT CAN BY THE USE OF GAMMA SPECTROSCOPY [CONTRIBUTIONS A LA CORRELATION DES ACTIVITES DU FLUIDE DE REFROIDISSEMENT D'UN REACTEUR AVEC L'APPARITION DU DEFAUT DE GAINE CHEZ LES ELEMENTS COMBUSTIBLES A L'AIDE DE LA SPETROMETRIE GAMMA]
Ecaterina Ionescu 1969 10 p refs In FRENCH
(IFA-FR-78) Avail: AEC Depository Libraries

Gamma ray spectroscopy is used to determine the relative energies of radioactive isotopes contained in the primary water circuit of a nuclear reactor. This method provides for an effective study of the corrosion processes in the coolant system. A laboratory experiment is performed to determine the isotopic periods and to test the complex gamma spectra of water decomposition. Transl. by J.M.C.

N70-26794# Battelle Memorial Inst., Columbus, Ohio.
PROGRESS ON DEVELOPMENT OF MATERIALS AND TECHNOLOGY FOR ADVANCED REACTORS DURING JULY - SEPTEMBER 1969
Donald L. Keller Oct. 1969 91 p refs
(Contract W-7405-eng-92)
(BMI-1872) Avail: CFSTI

Progress is reported on radiation effects on cladding materials as a function of radiation energy, on development of uranium-plutonium nitride fuels for LMFBR applications, and on fabrication and operation of in-pile creep tests using capsules containing plutonium and uranium oxide fuels. NSA

N70-26805# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
AEC FUELS AND MATERIALS DEVELOPMENT PROGRAM. PART 1 Annual Report
31 Mar. 1969 382 p refs
(Contract AT(40-1)-2847)
(GEMP-1012-Pt-1; AR-8) Avail: CFSTI

Processing techniques for the production of ductile, high purity molybdenum tubing are considered with emphasis on the effect of processing variables on mechanical properties, product quality, and cost. Tensile properties for wrought, arc-cast molybdenum sheet in the stress relieved and recrystallized conditions are determined. Radiation effects on fast reactor cladding and structural materials are also considered. J.M.C.

N70-26843# Minnesota Mining and Mfg. Co., St. Paul, Minn. Electrical Products Group.
SNAP-23A PROGRAM, PHASE 1: THERMOELECTRIC CONVERTER DEVELOPMENT PROGRAM Monthly Progress Report
20 Nov. 1969 29 p
(Contract AT(30-1)-3824)
(MMM-3824-41; MPR-23) Avail: CFSTI

Activities conducted included completing the design of all components for PMC-2 and completing its assembly. Technical liaison continued on the system-converter interface for PMC-2. The assembly of the first two fire safety modules was completed and the analysis of problems occurring during processing of SNAP-23A converter PMC-2 was initiated. Test data evaluation was performed on EMC-2, EMC-3, PMC-1B, and the 10-couple modules 1 and 3. NSA

N70-26844# Oak Ridge National Lab., Tenn. Technical Information Div.
RESEARCHES ON STABILIZATION OF UAl3 IN NUCLEAR FUELS OF HIGH ALUMINUM CONTENT
H. E. Exner et al [1969] 14 p refs Transl. into ENGLISH from Metall (German), v. 23, 1969 p 220 225 Presented at the 5th Intern. Meeting on Light Metals, Leoben, Austria, 1968 Sponsored by AEC
(ORNL-tr-2281) Avail: CFSTI

Methods of increasing the stability of the UAl3 phase in Al-U alloys, in preference to the brittle UAl4 phase, are discussed. Addition of other components, such as Zr and Ni are considered. It is shown that in these 3-component systems the UAl3 phase is in thermodynamic equilibrium with the aluminum matrix. NSA

N70-26878# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
POSTIRRADIATION NONDESTRUCTIVE EXAMINATION OF THE SM-2B FUEL ELEMENT FROM THE ARMY SM-1 POWER REACTOR
A. E. Richt and V. O. Haynes Jan. 1970 19 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2673) Avail: CFSTI

Results are given of the inspection of the experimental fuel element, SM-2B, after 13.5 MWyrs of service in the Army SM-1 Stationary Medium Power Reactor. The purpose of the inspection was to determine if the element was dimensionally and structurally suitable for testing to its design lifetime of 28.0 MWyrs. Results of this inspection indicated that the fuel element is acceptable for continued testing in the SM-1. No evidence of gross structural damage was apparent, gamma scans showed no indications of abnormalities in the fuel burnup distribution, and the external dimensions of the element were within acceptable limits. A few small intergranular cracks may be present in the cladding of the fuel plates but are thought to present no significant hazard to the reactor. The fuel element appeared to be suitable for continued testing and was returned to the SM-1 site. Author (NSA)

N70-26908# Los Alamos Scientific Lab., N. Mex.
GROOVED MELT WIRES FOR TEMPERATURE MEASUREMENT OF REACTOR FUEL
P. G. Salgado, B. J. Thamer, and R. L. Rudman Aug. 1969 11 p refs
(Contract W-7405-eng-36)
(LA-4321) Avail: CFSTI

The Ultra High Temperature Reactor Experiment (UHTREX) is being conducted as a part of the AEC gas cooled reactor program. One of the features of the reactor is the ability to refuel while operating at full power, accomplished in part by rotating the central core of the reactor. The already difficult job of measuring fuel temperature is thus made even more difficult because connecting tubes or wires cannot be used. As a means for measuring temperatures in UHTREX, certain fuel elements have been examined after test to see which of an implanted array of melt wires have melted, thus determining the temperatures within limits at various locations. Recent work has developed grooved melt wires of a variety of compositions covering the temperature range of 275 to 3000 F. Melting can be determined easily and with good precision by radiographing the exposed fuel element or by removing the melt wires and examining them visually. Author (NSA)

N70-26934*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STEADY-STATE PERFORMANCE OF A SNAP-8 DOUBLE-CONTAINMENT TANTALUM-STAINLESS STEEL MERCURY BOILER
Roy A. Lottig and Ronald H. Soeder Mar. 1970 64 p refs
(NASA-TM-X-52795) Avail: CFSTI CSCL 18N

Boiler performance mapping was performed between SNAP-8 system startup tests. The mercury boiler was a counterflow heat exchanger with double-containment, tantalum, and stainless steel construction. Boiler performance data obtained between early startup tests (3 through 21) indicated a boiler deconditioning (mercury-side surface contamination) problem. The boiler did condition (mercury-side surface contamination removed) for later startups (34 through 135) resulting in an overall pressure drop of 183 psi for a mercury flow rate of 6600 lbm/hr and a boiler inventory of 26 pounds. At the design mercury flow rate of 12,300 lbm/hr the boiler overall pressure drop was 129 psi with a boiler inventory of 34 pounds. The boiler NaK flow rate and inlet temperature for both of theabovemercury flow rates were approximately 46,000 lbm/hr and 1280 F and 45,700 lbm/hr and 1300 F, respectively. Author

N70-26943# Gulf General Atomic, San Diego, Calif.
THE 40-MW(E) PROTOTYPE HIGH-TEMPERATURE GAS COOLED REACTOR. POSTCONSTRUCTION RESEARCH AND DEVELOPMENT PROGRAM Quarterly Progress Report, Period Ending 31 Oct. 1969
26 Nov. 1969 49 p
(Contract AT(04-3)-314)
(GA-9797) Avail: CFSTI

The actual and calculated core reactivity change with burnup was analyzed, and data were accumulated for xenon decay and buildup measurements. Effective full-power day (EFPD) postirradiation examinations of Peach Bottom core components, hexagon reflector element B16 01 and control rod C08-01, showed no appreciable graphite dimensional changes, bowing, or twist. Predictions of control rod absorber dimensional changes based on these results and data taken from the literature indicated no apparent problems through 1500 EFPD of operation. The continuing analysis of fission product releases included gaseous fission products, diffusion probe data, and loop particulate matter. M.J.

N70-26967# Centre d' Etude de l'Energie Nucleaire, Brussels (Belgium).
SUBCRITICAL EXPERIMENTS Topical Report No. 12
J. Debrue, R. Delrue,(Belgonucleaire), W. Rotter (Euratom), and D. Van Deyck (Belgonucleaire) Aug. 1969 94 p refs Prepared jointly with Soc. Belge Pour l'Industrie Nucl.
(Contract EURATOM-001-64-1-TRUB)
(EURAEC-2125; EUR-4D18E; BN-6908-3) Avail: CFSTI

Two series of subcritical experiments performed at Mol from 1965 to 1967 are described. Both series of measurements employed U-235 enriched UO2 fuels in light water moderated lattices to provide supporting data for subsequent plutonium recycling studies. Measurements in 5% U-235 enriched lattices determined the prompt decay constant and the reactivity in various types of lattices. Measurements in 7% U-235 enriched lattices determined the reactivity and decay constant in high reflected assemblies. The various measurement techniques and analysis methods used are evaluated, and detailed results of the measurements are presented. NSA

N70-26971# Giessen Univ. (West Germany). Physikalisches Inst.
ISOTOPIC GENERATOR USING PHOTOELECTRIC CONVERSION [ISOTOPENGENERATOREN MIT PHOTOELEKTRISCHER CONVERSION]
A. Scharmann and U. Wegner Jun. 1969 28 p refs In GERMAN
(BMwF-FBK-69-23) Avail: AEC Depository Libraries

The mode of operation of photoelectric isotopic generators which consist of two energy conversions was investigated. The theoretical limitations of conversion were discussed and tested by three isotopic generators with specific activities of 7.5, 100, and 55 Ci Pm-147/g ZnS. Possibilities for the improvement of the efficiency are proposed. Author (NSA)

N70-26973# Brookhaven National Lab., Upton, N.Y.
BEHAVIOR AND TRAPPING OF FISSION PRODUCTS IN PRIMARY REACTOR CIRCUITS AND IN CONFINEMENT VESSELS OF FAST NEUTRON REACTORS
A. W. Castleman, Jr. Dec. 1969 19 p refs Presented at the Intern. Congr. on the Diffusion of Fission Products, Saclay, France, 4-6 Nov. 1969
(BNL-14242; CONF-691104-2) Avail: CFSTI

Experimental work related to fission product behavior in liquid Na systems, trapping of fission products, and behavior of the aerosols of nuclear materials is reviewed. Characteristics of equilibrium vaporization of fission products from liquid Na coolant are analyzed. Vaporization curves are included for Ba, Cs, Rb, Sr, NaI, and Te systems. Aerosol behavior for accident conditions in reactor containment system is analyzed. NSA

N70-26979*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EFFECT OF ADDING LITHIUM NITRIDE, HAFNIUM, TANTALUM AND TUNGSTEN TO A FAST-SPECTRUM, MOLYBDENUM-REFLECTED CRITICAL ASSEMBLY
John L. Anderson and Wendell Mayo May 1970 20 p refs Submitted for publication
(NASA-TM-X-52787; E-5641) Avail: CFSTI CSCL 18I

The change in fuel loading requirements and the resulting neutron energy spectrum are calculated when lithium nitride, hafnium, tantalum, and tungsten are added to the fast spectrum critical assembly. The assembly is designed to be a simulation of a conceptual fast reactor cooled by lithium, fueled with uranium-235 nitride, and reflected by molybdenum. Author

N70-27040# Atomics International, Canoga Park, Calif.
SNAP 8 AUTOMATIC STARTUP AND PCS MERCURY INJECTION SIMULATION TESTS
R. F. Audette 31 Oct. 1969 51 p refs
(Contract AT(04-3)-701)
(AI-AEC-12850) Avail: CFSTI

SNAP 8 reactor dynamic tests demonstrated the capability for fully automatic startup over eight decades from shutdown, and for automatically furnishing the heat load demand imposed by automatic startup of the flight system power conversion loop following reactor automatic startup. Test results are presented. Due to test limitations imposed by the ground test heat exchanger (IHX) in the heat rejection loop, reactor dynamics tests to the full predicted capability for the SNAP 8 Nuclear System were not performed. The heat exchanger was originally designed only for steady state heat transfer service. However, the tests performed approximate predicted flight system operation, and it can be reasonably extrapolated from the test results that the SNAP 8 reactor will provide the dynamic response characteristics required for the flight system. Author (NSA)

N70-27092# Idaho Nuclear Corp., Idaho Falls.
CHEMICAL TECHNOLOGY BRANCH Annual Report, 1969
J. R. Bower, ed. Oct. 1969 103 p refs
(Contract AT(10-1)-1230)
(IN-1314) Avail: CFSTI

Research progress is reported on performance of ICP fuel recovery processes, fluidized-bed denitration of ICPP product, graphite fuels reprocessing, electrolytic dissolution process for EBR-2 fuel, zirconium oxide fuel process, operating experience in the Idaho Waste Calcining Facility, storage of solid waste, calcination using in-bed combustion of fuel for heating, waste management studies, LOFT assistance program, and other reactor technology support programs. NSA

N70-27094*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
IN-PILE GAMMA DOSIMETRY MEASUREMENTS WITH OXALIC ACID
J. L. Power 1969 19 p refs Presented at Natl. Symp. on Develop. in Irradiation Testing Technol., Sandusky, Ohio, 9-11 Sep. 1969; Sponsored in part by AEC
(NASA-TM-X-62893) Avail: CFSTI CSCL 18 D

The results of a study to measure gamma dose rates in the NASA Plum Brook Reactor are presented. Measurements in an aqueous environment were required in an in-core location during reactor operation at full power of 60 MW and at 40MW. The major conclusions of the study are: (1) Concentrated oxalic acid can be reliably and readily used as a gamma dosimeter in reactor environments with gamma dose rates as high as 4 W/g. (2) For 0.60 M H20x dosimeter samples decomposed between 50 and 90%, the gamma dose rates calculated from the original Draganic relationship are consistent with each other, with the available PRB reference data for LB-11, and with temperature rise data obtained

on similar samples. (3) Determinations of gamma dose rates by the decomposition of concentrated H2Ox have excellent reproducibility. (4) Titration with NaOH in a CO2-free aqueous environment is a convenient, accurate, and simple analytical method for determining the H2Ox remaining in irradiated dosimeter samples. D.L.G.

N70-27140*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
COMPATIBILITY AND SHIELDING ANALYSIS OF SCIENCE INSTRUMENTS IN SPACECRAFT CONTAINING A RADIOISOTOPE THERMOELECTRIC GENERATOR
C. G. Miller and V. C.Truscello 1 May 1970 35 p refs
(Contract NAS7-100)
(NASA-CR-109853; JPL-TR-32-1427) Avail: CFSTI CSCL 18N

The use of radioisotope thermoelectric generators as a solar-independent power source in spacecraft is considered. The probability of misinterpretation of generator-produced neutron and gamma fields for naturally occuring phenomena by onboard science instruments is investigated. Spatial deployment and shielding requirements are discussed. Geiger-Mueller tubes, electron multipliers, and silicon surface-barrier detectors are evaluated in detail. Because the sensitivity of the science instruments varies with the energy of the radiation, a 20-group structure in the 0.04 to 10-MeV range was developed to determine the spectral distribution of the radiation energy. Analytic models are developed to predict the effect of these spectra on the instruments selected. The possible degradation of spacecraft electronics is also investigated. The principal findings were that the gamma-photon field does affect the operation of the instruments, while the neutron field does not--either directly or indirectly through capture-gamma production. The age of the fuel is a factor in determining the amount of background interference. The degradation threshold for most electrical components is above the level produced by the fuel. A marginal case exists for injection transistors; methods are proposed for alleviating this condition. Author

N70-27200*# Aerojet-General Corp., Azusa, Calif.
SNAP-8 TUBE-IN-TUBE MERCURY BOILER DEVELOPMENT USING 9% CHROME, 1% MOLY STEEL
E. S. Chalpin and G. L. Lombard Oct. 1969 108 p refs
(Contract NAS5-417)
(NASA-CR-72531; AEROJET-3662) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 18 N

Four configurations of the NaK-to-mercury tube-in-tube boiler using 9% chromium-1% molybdenum steel (9M) as the mercury containment material were fabricated and tested in the SNAP-8 program. The thermal and mechanical designs as well as the performance of each boiler are described. The problems of conditioning the boilers in a mercury environment, corrosion, decarburization and concomitant or subsequent cracking of the 9M material, and the thermal stress failure of the Type 321 stainless steel boiler shell prevented these configurations from attaining the 10,000-hour life requirement. Methods of determining predictable thermal performance, fabrication techniques and the types of tests performed are presented. Author

N70-27208# Oak Ridge National Lab., Tenn.
DESIGN, CONSTRUCTION, AND TESTING OF HIGH EFFICIENCY AIR FILTRATION SYSTEMS
C. A. Burchsted and A. B. Fuller Jan. 1970 196 p refs
(Contract W-7405-eng-26)
(ORNL-NSIC-65) Avail: CFSTI

A handbook is presented on the design, construction, and testing of very high-efficiency air-cleaning systems with the emphasis on contaminated exhaust air cleaning systems for nuclear plants, laboratories, reactor installations, and other facilities in which radioactive materials are handled. Detailed information is given on operational procedures, environmental factors, emergency requirements, maintenance, cost, and the types of mechanical equipment necessary. The last includes the ventilating system with its ducts, fans, controls, and instrumentation and the various filter systems with their components. The design, construction, and performance of high-efficiency filters, building supply air filter, activated-carbon absorbers, and moisture separators are discussed. Filtration systems for enclosures, particularly glove boxes, are presented. Finally, remotely maintained and reactor postaccident cleanup filtration systems are described. NSA

N70-27214# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
SINTER: A PROGRAM FOR CALCULATING RADIAL TEMPERATURE DISTRIBUTIONS IN OXIDE FUEL PINS UNDERGOING SINTERING
K. R. Merckx and G. L. Fox Jan. 1970 19 p
(Contract AT(45-1)-1830)
(BNWL-1241) Avail: CFSTI

SINTER is a program for calculating the steady state radial temperature distribution within the fuel material of cylindrical fuel rods. The method uses the integral of the thermal conductivity over the temperature range which includes the temperature dependence for thermal conductivity. The fuel temperature distribution includes the effect of restructuring or sintering of the fuel material. The radius of the central void caused by such sintering is also calculated. The theoretical basis of the procedure for calculating the temperature distributions and the geometrical changes is reviewed. Author (NSA)

N70-27221 National Lending Library for Science and Technology, Boston Spa (England).
A THERMAL METHOD FOR REMOVING STEEL CANS FROM OXIDE FUEL ELEMENTS
C. P. Novosyelov et al 1969 18 p Transl. into ENGLISH from At. Energ. (USSR), v. 26, no. 3, Mar. 1969 p 230-233
(NLL-WINDSCALE-Trans-413-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A method of separating the steel cladding from the fuel element clusters by heating to the temperature at which steel melts is described. The interaction of uranium and plutonium dioxides with molten stainless steel and the wetting characteristics of the steel were investigated. Using the thermal method, steel was obtained in the form of ingots or granules and the dioxides in the form of briquettes. The method also produced a fairly high yield, an insignificant amount of waste, and no fuel dust. N.E.N.

N70-27225# Oak Ridge National Lab., Tenn.
DESIGN CONSIDERATIONS OF REACTOR CONTAINMENT SPRAY SYSTEMS. PART 7: A METHOD FOR CALCULATING IODINE REMOVAL BY SPRAYS
L. F. Parsly Feb. 1970 22 p
(Contract W-7405-eng-26)
(ORNL-TM-2412-Pt-7) Avail: CFSTI

A method of analyzing the performance of reactor containment building sprays for the removal of elemental iodine is described. The method depends on the analytical solution to the diffusion equation with surface resistance. Computed values of the solution over a sufficient range of parameters to cover all cases likely to be of interest in safety analyses are presented both graphically and in tabular form. A method of selecting the mean droplet diameter to be used in the calculations is described, and the rationale of the choice is discussed. The recommended procedures should yield conservative predictions of spray performance. A sample calculation using the proposed method is presented. This shows that the calculation predicts a 2-min half-life for removing iodine from a typical PWR containment building. About 10% of the total mass transfer resistance is in the liquid. Author (NSA)

N70-27236# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
TAP-LOOP: A STABLE THERMAL ANALYZER CODE FOR THERMAL ANALYSIS OF CLOSED HYDRAULIC SYSTEMS
C. E. Leach and E. L. Kelley, Jr. Jan. 1970 150 p refs
(Contract AT(45-1)-1830)
(BNWL-1172) Avail: CFSTI

A finite difference digital code for steady-state and transient thermal analysis of recirculating fluid loops, TAP-LOOP, was derived from the original TAP code developed by Atomics International. Stability improvement and transport lag times were incorporated in the TAP code to provide a more useful design tool for thermal analysis of closed hydraulic systems. Theory, logic, program listing, input and test case results are given. Author (NSA)

N70-27242# Babcock and Wilcox Co., Lynchburg, Va.
ZERO-POWER TESTS ON PM-4 REACTOR CORE 2
G. T. Fairburn Jan. 1970 40 p
(Contract AT(30-1)-4099)
(BAW-4099-1) Avail: CFSTI

Zero-power tests on the PM-4 Reactor Core II are described. Detector response was measured at specific locations during core submersion and approach to criticality. The stuck-rod criteria and core uniformity were confirmed. The most reactive control rod was calibrated; the total indicated worth is 5.08% Delta k/k at 68.0 F, and 4.49% Delta k/k at 168.4 F. The temperature coefficient was measured up to 172.8 F. The total excess reactivity was measured using boric acid techniques. The excess indicated is 14.66% Delta k/k. All tests were performed with 24 poison pins in the core and with stainless steel mockups of the thermal shrouds and pressure vessel. The tests were completed 45 days after receipt of the core. Author (NSA)

N70-27346# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CONTROL OF FISSILE MATERIAL LOSSES DURING PROCESSING OF RAPSODIE FUELS [CONTROLE DES PERTES DE MATIERES FISSILES DANS LE TRAITEMENT DU COMBUSTIBLE DE RAPSODIE]
Pierre Jover, Pierre Janot, Jean-Francois Gey, and Georges Malet Feb. 1970 28 p refs In FRENCH; ENGLISH summary
(CEA-R-3961) Avail: CFSTI

Equipment designed to control losses of fissile materials in leached hulls during the processing of fuel from the Rapsodie reactor in the pilot plant AT1 (La Hague) is described. In this method the leached hulls are placed in baskets and irradiated using a neutron generator; the delayed neutrons emitted after irradiation are then counted. It is possible to control a basket containing 10 kilos of leached hulls in 30 minutes, and to detect 50 mg of U235. Author (ESRO)

N70-27423# Brookhaven National Lab., Upton, N.Y.
A SUMMARY OF RECENT PROGRESS IN AEROSOL RESEARCH AT BROOKHAVEN NATIONAL LABORATORY
A. W. Castleman, Jr. [1969] 15 p refs Presented at the Specialist Meeting on the Behavior of Nucl. Aerosols in Closed Systems, Karlsruhe, Ger., 11-12 Nov. 1969
(BNL-14271; CONF-691113-1) Avail: CFSTI

A long range research program is under way with the primary objective of developing a fundamental understanding of the chemical reactions, mechanisms of release, and transport behavior of the fission products and radioactive aerosols emanating from nuclear materials under conditions likely to be encountered in the event of an LMFBR accident. Work is in progress to provide information on the nature of aerosols composed of PuO2, UO2, sodium, and combinations of each. In addition to the experimental work, a large theoretical research effort is under way to provide a basic understanding of aerosol behavior in closed systems. Computer codes are being developed for use in predicting the time dependence of the mass concentration, number concentration, and particle size distribution. These codes are used in data correlation and evaluation as well as for making scale-up calculations to realistic power-reactor accident conditions. Author (NSA)

N70-27455# Atomics International, Canoga Park, Calif.
LMFBR SAFETY PROGRAMS Quarterly Technical Progress Report, Jul. Sep. 1969
15 Nov. 1969 13 p
(Contract AT(04-3)-701)
(AI-AEC-12885) Avail: CFSTI

Experimental and analytical methods characterizing the release and transport of effluents and energy generated during major LMFBR sodium accidents are discussed. A sodium fire test in a large pool fire modeling experiment was conducted. Analysis of the air, floor, and wall samples collected during the sodium fire was initiated. Tabular results are given for the sodium spray fire experiments in reduced oxygen environments. Tests were conducted in a laboratory test chamber in which vaporized UO2 was released using a carbon-carbon electrode system. A computer program was modified which calculated the settling velocity of the aerosol models. Experimental and modeling techniques were further developed for the prediction of the consequences of a major LMFBR accident and its effects on building pressure and leakage of the released aerosol. S.S.

N70-27468# Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF THE INITIATION AND EXTENT OF DUCTILE PIPE RUPTURE, PHASE 2 Progress Report, Oct. Dec. 1969
Robert J. Eiber, Willard A. Maxey, Arthur R. Duffy, and Thomas J. Atterbury Jan. 1970 7 p refs
(Contract W-7405-eng-92)
(BMI-1876) Avail: CFSTI

Activities in a program to develop methods of testing and predicting rupture in reactor cooling system pipes are reported. An experiment was conducted during the period in which a test pipe was pressured to failure. The predicted pressure at 564 F was 2250 psig and the actual failure occurred at 2400 psig. Data are included on rupture as function of time, and pressure measured as function of time. NSA

N70-27487# European Atomic Energy Community, Karlsruhe (West Germany). Joint Nuclear Research Center.
STUDY ON THE TERNARY SYSTEM UO2-U3O8-PuO2
U. Benedict and C. Sari 1970 38 p refs
(EUR-4136-e) Avail: CFSTI

Sintered pellets of uranium-plutonium mixed oxides with Pu/U + pu ratios from 5% to 90% were oxidized under appropriate oxygen partial pressures at different temperatures. The oxidized samples were analyzed by ceramography and X-ray diffraction. At room temperature a two phase region MO(2 + x) + M4O9 was observed with O/M up to 2.20 and Pu/U + Pu or = to 0.30. At 1400 C a single fluorite phase exists for all Pu concentrations and O/M up to 2.27. Above O/M = 2.27 and for overall Pu/U + Pu ratios below 0.5, a plutonium-rich fluorite phase is in equilibrium with a uranium-rich orthorhombic U3O8-type phase. When oxidation takes place at 600 C a metastable phase of the tetragonal U3O7 type is formed for Pu/U + Pu 0.25 and O/M or = to 2.28, and no segregation of plutonium occurs between the U3O8-type phase and the fluorite phase, because cation diffusion is too slow at that temperature. The oxidation limit in air was determined for all compositions and temperatures studied. The pattern of the U3O8 structure was completely indexed with reference to its pseudohexagonal form, and the dependence of its lattice parameters from oxygen and plutonium content was studied. Author

N70-27500# Reactor Centrum Nederland, Petten.
PRESSURIZER DYNAMICS: RESPONSE TO LOAD TRANSIENTS
A. van den Honert (Ph.D. Thesis) Dec. 1969 206 p refs
Sponsored jointly by Roy. Dutch Navy, Neratoom and Technol. Univ. of Delft
(RCN-112) Avail: CFSTI

The various steady state and transient phenomena, occurring in a (nuclear) pressurized water reactor pressurizer, are described in this document. Most of the information presented was obtained by experiments performed with a 1100 pressurizer, working at a steady state pressure of 125 at. The desired perturbations of the steady state condition were effected by a reactor simulating circuit, summarizing the results it may be stated that the information, presented in this document, is believed to yield a better insight in the different transfer phenomena, and should consequently be of assistance in developing less conservative design procedures. Author (ESRO)

N70-27514*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN GUIDES FOR IRRADIATION EXPERIMENTS WITH FAST SPECTRUM REACTOR FUEL ELEMENTS IN THERMAL TEST REACTORS
John L. Anderson Washington May 1970 24 p refs
(NASA-TM-X-2012; E-5160) Avail: CFSTI CSCL 18I

Multigroup calculations provide a comparison of various techniques for simulating the effects of a fast reactor spectrum during the irradiation of fueled experiments in thermal test reactors. Spectral requirements are met by thermal flux spectra that are modified by removing thermal neutrons with cadmium and/or boron-10 absorbers. Power profile requirements in fueled samples are met by reducing the uranium-235 enrichment and/or reducing the sample size. Author

N70-27524# Argonne National Lab., Ill.
INVESTIGATION OF METALLURGICAL PROBLEMS ASSOCIATED WITH THE EBR-2 FUSIBLE SEALS. EBR-2 PROJECT
Charles C. Crothers Sep. 1969 28 p refs
(Contract W-31-109-eng-38)
(ANL-7589) Avail: CFSTI

Fusible seals composed of a bismuth and tin alloy in the eutectic ratio are used in the EBR-II rotating shield plugs. Because the seal alloy is exposed to sodium in the form of vapor or aerosol from the primary tank, the plug seals were a continuing source of difficulty since the system became operable. The solubility of sodium in the seal alloy at its normal operating temperature was investigated. Intermetallic compounds of sodium with bismuth or tin usually had melting points above the operating temperature range of the fusible seals. The results of thermal analyses of a series of alloys containing bismuth and tin in the eutectic ratio and varying concentrations of sodium showed that the solubility of sodium in bismuth-tin eutectic alloy was approximately 0.35 wt % at 177 C. Apparently solids resulting from the reaction of sodium with the seal alloy did not begin to build up in the seals until this solubility was exceeded. Similar analyses were made of a series of alloys containing bismuth and tin in the eutectic ratio and approximately 1 wt % indium and varying concentrations of sodium. The solubility of sodium in the alloy containing indium was approximately 0.50 wt % at 177 C. Some associated experiments concerning dross-formation rates, alloy purification, and corrosion are reported. Author (NSA)

N70-27546# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.
FABRICATION OF CERAMIC MATERIALS BY MELTING IN AN OVERPRESSURE ELECTRIC ARC FURNACE
F. Thuemmler, H. Wedemeyer, and C. Politis Aug. 1969 14 p refs
(KFK-1023) Avail: AEC Depository Libraries

To melt ceramic materials of very high purity an arc furnace was developed in which it is possible to work under an overpressure of up to 20 atm. The installation is equipped with a mold carrier for button specimens and interchangeable crucibles for larger charges and can be used with a permanent electrode or a consumable electrode. The power supply includes a rectifier which at no-load voltage of 75 V gives a maximum melting current of 2250 A, and of 1120 A at 150 V. The range of application of the over-pressure arc furnace ranged from the preparation of particularly pure laboratory specimens to the preparation of massive fused ceramic bodies. By working under high inert gas pressure, it was possible to produce melts of mixtures of materials of different melting points such as UO2 and Cu. Under high nitrogen pressure it was possible to directly convert metals with higher melting points into nitrides, even those with a high decomposition pressure such as UN. Author (NSA)

N70-27575# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
SURVEILLANCE AND IN-SERVICE INSPECTION RECOMMENDATIONS FOR THE FTR: TECHNIQUES, PROGRAM, DEVELOPMENT
J. J. Buggy, D. L. Dill, and E. Paxson Feb. 1969 192 p refs
(Contract AT(30-1)-3977)
(WARD-3977-1) Avail: CFSTI

Surveillance and in-service inspection of the FTR reactor internals and reactor system components are recommended to assist in preventing failures that could affect the preservation of public health and safety, and to guard against failures that could have significant effects on plant availability, repair cost, and time. For the reactor internals, the recommended inspections include: Continuous capability for diagnostic monitoring using noise analysis; Frequent in-vessel general visual inspection under sodium using an acoustic viewing system; A materials program consisting of continuous irradiation of specimens in the FTR with periodic ex-reactor testing; Infrequent in-vessel detailed visual inspection under sodium using an acoustic viewing system, and infrequent, and only as required depending upon reactor operation and other inspection results, in-vessel and ex-vessel dimensional measurements, visual inspection, and non-destructive testing. Author (NSA)

N70-27606# Atomics International, Canoga Park, Calif.
LMFBR PHYSICS PROGRAMS Quarterly Technical Progress Report, Jul. Sep. 1969
15 Nov. 1969 27 p refs
(Contract AT(04-3)-701)
(AI-AEC-12884) Avail: CFSTI

A series of experiments in which the reactivity worth of Ta was established over a large range of surface-to-mass values was used to derive a normalization factor for calculated control rod worths in an FBR reactor. This intercomparison study serves to reduce the uncertainties in the number of control rods which must be installed in an FBR in order to handle all possible excess reactivity conditions. A pin-type test zone has been designed and is under construction for measuring engineering and physics parameters of importance to FBR design and safety. The test zone which will be installed in the ECEL reactor consists of hexagonal pin-type fuel elements geometrically very similar to current FBR fuel element concepts. Author

N70-27658# Bettis Atomic Power Lab., Pittsburgh, Pa.
EFFECT OF CARBOWAX BINDER AND DEXTROSE ADDITIVE ON THE MICROSTRUCTURE, DENSITY, AND OPEN POROSITY OF THORIA-URANIA FUEL PELLETS (LWBR DEVELOPMENT PROGRAM)
T. J. Burke Nov. 1969 48 p refs
(Contract AT(11-1)-GEN-14)

(WAPD-TM-880) Avail: CFSTI

The method and results are presented for an investigation to determine the effects of adding various amounts of glucose to thoria-urania systems agglomerated with 1, 2, and 3 wt % Carbowax 6000 binder. The effects reported are porosity, sintered density, and microstructure with respect to cold compacted fuel pellets covering a wide range of pellet densities. Author (NSA)

N70-27662# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

PECT-1: A FORTRAN 4 COMPUTER PROGRAM TO DETERMINE THE PLASTIC-ELASTIC CREEP AND THERMAL DEFORMATIONS IN THICK-WALLED CYLINDERS

F. E. Bard, Jr. Dec. 1969 87 p refs

(Contract AT(45-1)-1830)

(BNWL-1171) Avail: CFSTI

The adaptation of the PECT-I code to the problem of evaluating clad deformations in FTR fuel pins is described. A rheological model was developed, and a particular numerical procedure (for integrating with respect to space and time) was used to give a stable solution for the resulting rate equations. The numerical results show the effects of thermal and mechanical loading and different material properties on stress and strain in a thick wall cylinder. Based on these results, it is concluded that maximum cladding deformation occurs at either the midplane or hot end of the fuel pin, depending upon the material properties. Author (NSA)

N70-27665# Argonne National Lab., Ill. Reactor Physics Div.

A STUDY OF THE PHYSICAL PROPERTIES OF NOMINAL 0.7, 3, AND 6 a/o BURNUP UO2 FAST-REACTER FUEL PINS PREPARATORY TO TRANSIENT TREAT EXPOSURE

R. R. Stewart, C. E. Dickerman, N. R. Stalica, and W. B. Doe May 1969 68 p refs

(Contract W-31-109-eng-38)

(ANL-7571) Avail: CFSTI

The physical condition of 0.7, 3.0, and 6.0 a/o burnup UO2 fast-reactor fuel pins is documented by numerous charts, tables, neutron and x-ray radiographs, photographs, photomicrographs, and beta–gamma and alpha radiographs. Solid and gaseous fission products are generated during steady-state irradiation of UO2. Some of these fission products are retained within the UO2 matrix, causing changes in the physicochemical composition and dimensional stability of the fuel. These effects are discussed. Five fuel pins were used for destructive examination, as many as 18 separate samples being examined from one pin. These five pins were representative of the 0.7, 3.0, and 6.0 a/o burnup groups, which had been irradiated at an initial power density of 2.5 kW/cu cm, corresponding to initial fuel centerline and fuel surface temperatures of 2400 and 1215 C, respectively. Extensive studies were made on several pin cross sections from each burnup group using an electron-microprobe analyzer. Author (NSA)

N70-27672# Gulf General Atomic, San Diego, Calif.

METHODS FOR DETERMINING COATING CONTAMINATION AND ITS DISTRIBUTION IN NUCLEAR FUEL PARTICLES

K. P. Steward 27 Aug. 1969 51 p refs Presented at the Fall Meeting of Am. Ceramic Soc., Seattle, 15-17 Oct. 1969

(Contract AT(04-3)-633)

(GA-9608; CONF-691027-1) Avail: CFSTI

Studies were made on the level of contamination and its distribution in the BISO and TRISO fuel particles. Electron microprobe analysis used to determine contamination profiles in highly contaminated BISO particles, and the coating removal/activation analysis and mica foil techniques were used to obtain the uranium electron microprobe was most useful for measuring high contamination levels down to 100 ppM, the grinding/activation analysis technique for medium contamination levels down to perhaps 0.2 ppM, and the mica foil technique down to about 0.001 ppM. The upper limit was 10 ppM for the mica foil method due to the high track density obtained at such contamination levels. Reduction of irradiation time and/or fluence could increase this by an order of magnitude or more. NSA

N70-27673# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.

CORROSION OF STAINLESS STEEL AND DEPOSITION OF PARTICULATES IN FLOWING SODIUM SYSTEMS. TASK 6: EVALUATION OF MASS TRANSFER STATE-OF-THE-ART AND ANALYSIS OF FFTF FUEL CLADDING, PIPING, AND CLOSED LOOP MATERIAL DEGRADATION RATES

G. P. Wozadlo and C. N. Spalaris Sep. 1969 30 p refs

(Contract AT(04-3)-189)

(GEAP-13544) Avail: CFSTI

Corrosion allowances for sodium coolad reactor components have been summarized on the basis of data obtained in laboratory loops. These allowances take into account environmental factors affecting corrosion, except possibly radiation. No scale-up effect is expected in going from test loops to reactor systems for peak temperature regions (reactor core); since the geometry of the flow passages in these regions is simulated in loop tests. Scale-up effects in other, lower temperature regions, may be appreciable, but are probably less critical to design. Recommendations are made for additional work necessary to reduce technological risk associated with application of present data. Author (NSA)

N70-27674# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

REACTOR FUELS AND MATERIALS DEVELOPMENT PROGRAMS FOR FUELS AND MATERIALS BRANCH Quarterly Progress Report, Jul.–Sep. 1969

W. F. Sheely, ed. Nov. 1969 251 p refs

(Contract AT(45-1)-1830)

(BNWL-1223) Avail: CFSTI

The research and developments during this period are reported. Included are: (1) nondestructive testing of thermal transducers, critical angle reflectivity technique, and Mossbauer backscatter system; (2) summaries of irradiation damage to reactor metals; and (3) fast reactor ceramic fuels. NSA

N70-27688# Reactor Centrum Nederland, Petten.

FAST REACTOR PROGRAMME Quarterly Progress Report

E. K. Hoekstra, comp. Dec. 1969 67 p refs

(RCN-114; QPR-2) Avail: CFSTI

This progress report covers fast reactor research carried out by RCN during the second quarter of 1969 and forms part of the integrated fast breeder research and development programme also in progress at the national nuclear research centres Karlsruhe and Mol. The RCN contribution is mainly concerned with the core of the fast breeder reactor and related safety aspects and, as such, must be looked upon as being complementary to the industrial research programme in the field of fast reactors. This contribution and scope of the report covers the following six items: a reactor physics programme to determine the influence of fission products on several main characteristics of the reactor core such as void coefficient, Doppler coefficient and breeding ratio; a fuel performance programme in which both stationary and transient irradiations are being carried out to establish the temperature and power limits of fuel rods, also the consequences of loss-of-cooling are investigated; investigation into the change in mechanical properties of fuel canning materials due to high fast neutron doses; a study of the corrosion behaviour of canning materials and their compatibility with the fuel under conditions of high temperature and high pressure; investigation into the behaviour of aerosols of fission products which could be formed after a fast reactor accident, a thorough understanding of which is of utmost importance for the reactor safety assessment; studies on heat transfer in the reactor

core. As fast breeders operate at high power densities, an accurate knowledge of heat transfer phenomena is required. Author (ESRO)

N70-27690# Battelle-Northwest, Richland, Wash. Chemistry and Metallurgy Div.
BIPPY: A COMPUTER CODE FOR THE CORRELATION OF FUEL ELEMENT BURNUP AND CLADDING DAMAGE
R. E. Dahl, Jr. and R. D. Bourquin Dec. 1969 28 p refs
(Contract AT(45-1)-1830)
(BNWL-1247) Avail: CFSTI

The method and equations used in the computer code BIPPY are presented so that results obtained using this method can be evaluated. This code is used to calculate at incremental burnup levels: concentrations of fissile, fertile, and any ten fission product isotopes: lineal heat generation and power density in the fuel pin: heavy element depletion: total neutron fluence: fluence of neutrons with energies greater than 0.1 MeV; cladding damage according to five models; and specific power. Input includes the beginning fuel composition, fuel pin dimensions, neutron flux, and the neutron spectrum. The code is intended for analysis of fast reactor fuel irradiations. No self shielding is considered. Author (NSA)

N70-27693# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
BISYN-PERT: A TWO-DIMENSIONAL PERTURBATION MODULE FOR THE BISYN SYSTEM
M. D. Kelley and T. R. Jones Apr. 1969 26 p refs
(Contract AT(04-3)-189)
(GEAP-10046) Avail: CFSTI

The BISYN-PERT routine uses the two-dimensional, synthesized flux and adjoint flux distributions from the BISYN code and computes reactivity changes associated with a variety of reactor perturbations, chosen at the option of the user. Perturbation effects may be calculated by regions, specified subregions, or mesh point. Advantages and limitations of the BISYN-PERT routine are included. Author (NSA)

N70-27700# Du Pont de Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.
SILICATES AS INHIBITORS OF ALUMINUM CORROSION IN SAVANNAH RIVER REACTORS
Robert S. Ondrejcin Dec. 1969 19 p refs
(Contract AT(07-2)-1)
(DP-1197) Avail: CFSTI

The corrosion rate of aluminum cladding on fuel elements in Savannah River reactors was reduced by lithium silicate. Fuel tubes were treated to form a film of lithium aluminosilicate about 1 micrometer thick on the aluminum surfaces. Corrosion of treated aluminum surfaces decreased as much as 50% after four days. After 50 to 60 days of reactor operation, treated and untreated aluminum had the same oxide thickness. Corrosion of both treated and untreated aluminum decreased 30% (on the basis of hydrogen evolution) due to the addition of a maximum of 0.5 ppM combined soluble and polymeric silica to the moderator. The addition also decreased the turbidity by reducing the concentration of hydrated aluminum oxides to < 0.5 ppM, and consequently decreased the concentration of the associated fission products. Author (NSA)

N70-27702# Bettis Atomic Power Lab., Pittsburgh, Pa.
OBSERVATIONS ON THE IRRADIATION BEHAVIOR OF A ZIRCALOY-4 CLAD ROD CONTAINING LOW DENSITY ThO2-5.3 w/o UO2 PELLETS (LWBR DEVELOPMENT PROGRAM)
J. E. Mc Cauley Dec. 1969 60 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-664) Avail: CFSTI

A rod-type fuel element, containing low density ThO2 – 5.3 wt % UO2 fuel pellets and sheathed in Zircaloy-4, was irradiated to a peak depletion of 1.5 × 10 to the 20th power fissions per cubic centimeter of oxide fuel. The element was located in a relatively steep thermal flux gradient during its entire irradiation lifetime. Post-irradiation observations of grain growth and central void formation in this oxide fuel were found to be reasonably consistent with current theoretical treatments of these phenomena. The irradiation history defined for rod 79-76 as a function of specimen axial location and in-reactor test time, was supported indirectly by a semi-quantitative evaluation of the microstructural changes obtained in the oxide pellets. Author (NSA)

N70-27704# Gulf General Atomic, San Diego, Calif.
FAST REACTOR SPECTRUM MEASUREMENTS Quarterly Progress Report, Period Ending 31 Oct. 1969
J. C. Young, P. D'Oultremont, and J. M. Neill 13 Nov. 1969 37 p refs
(Contract AT(04-3)-167)
(GA-9817) Avail: CFSTI

Calculated and measured neutron spectra are compared in the exponential piles of STSF fast reactors. The performance of fast neutron radiation detectors is evaluated. NSA

N70-27708# Battelle-Northwest, Richland, Wash. Nuclear Safety Branch.
NUCLEAR SAFETY BRANCH OF USAEC DIVISION OF REACTER DEVELOPMENT AND TECHNOLOGY Quarterly Report, Aug. – Oct. 1969
Dec. 1969 117 p refs
(Contract AT(45-1)-1830)
(BNWL-1266) Avail: CFSTI

Progress is reported for work done in the following areas: engineering safety systems, pressure bearing component evaluation and monitoring, environmental studies, and fixation of radioactive residues. J.M.C.

N70-27709# Babcock and Wilcox Co., Lynchburg, Va. Research and Development Div.
GEL-ADDITION PROCESS CHEMICAL STUDIES Quarterly Progress Report, Aug. – Oct. 1969
R. V. Carlson, comp. Dec. 1969 42 p refs
(Contract AT(30-1)-3714)
(BAW-3714-15; QPR-13) Avail: CFSTI

The development of a sol-gel process and related processes for preparing (U, Pu)O2 fast reactor fuels has continued. About 4.3 kg of ceramic-grade powder containing 20% PuO2 in fully enriched UO2 were prepared by continuous coprecipitation for irradiation in the EBR-2. The construction and cold checkout of a unit-operation-scale system for forming (U, Pu)O2 sol-gel microspheres were completed. All pellet, vipac, and sphere-pac fuel pins required for the FY-1970 irradiation program in the BAWTR were fabricated and are awaiting end-cap welding. The pellets containing 20% PuO2 in fully enriched UO2 were fabricated as required for the initial EBR-2 irradiation test. Author (NSA)

N70-27734# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
INVESTIGATIONS OF NEUTRON NOISE IN THE BRAUNSCHWEIG RESEARCH AND TESTING REACTOR (FMRB) [UNTERSUCHUNG DES NEUTRONENRAUSCHENS AM FORSCHUNGS-UND MESSREAKTOR BRAUNSCHWEIG (FMRB)]
E. Viehl Mar. 1969 15 p refs In GERMAN
(FMRB-13/69) Avail: AEC Depository Libraries

An introduction into the theory of reactor noise is given, followed by first measurements of the auto spectral density at the Measuring and Research Reactor (FMRB). The reactor power

determined by reactor noise was in good agreement with the value given by the instrumentation, which has been calibrated by nuclear power measurements. The prompt neutron lifetime depends upon the measuring position. Values were found at the edge of the core between about 69 and 74 microseconds. Author (NSA)

N70-27735# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Reaktorphysik.
INTERPRETATION OF DOPPLER SAMPLE MEASUREMENTS IN FAST CRITICAL ZERO-ENERGY ASSEMBLIES
E. A. Fischer May 1969 101 p refs Transl. into ENGLISH from the German Report KFK-844 Sponsored by US/Euratom Fast Reactor Exchange Program
(EURFNR-669; KFK-844) Avail: CFSTI

Application of perturbation theory to the analysis of Doppler sample measurements made in zero power assemblies is detailed. The multigroup integral transport equation is formulated. The perturbation theory solution to the equations describing the heated sample measurements is derived; the recursion formulae for the iterative evaluation of the integrals are given. Analytical methods used in processing the data from the Doppler samples are discussed; the pertinent equations are formulated. Effects of the heating of the Doppler samples are evaluated. A detailed analysis of the theory of the Doppler coefficient for fast reactors is given. Results of calculations and analyses are shown graphically; these results are compared with ZPR measurements of a similar nature. NSA

N70-27737# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
APPLICATION OF NEW FAST CHEMICAL SEPARATIONS IN THE DETERMINATION OF THE CHARGE DISTRIBUTION IN LOW-ENERGY FISSION [APPLICATION DE NOUVELLES SEPARATIONS CHIMIQUES RAPIDES A LA DETERMINATION DE LA DISTRIBUTION EN CHARGES DANS LA FISSION A BASSE ENERGIE]
J. Blachot, L. C. Carraz, P. Cavallini, A. Gadelle, and A. Moussa [1969] 12 p refs In FRENCH Presented at the 2nd Conf. on Phys. and Chem. of Fission, Vienna, 28 Jul.–1 Aug. 1969
(CEA-CONF-1369; CONF-690708-5) Avail: AEC Depository Libraries

Rapid chemical methods of separation were developed. The first was based on the recoil of fission products in RuCl3, then heating the mixture to 600 C in a tube with a temperature gradient. It is possible in this way to separate, with good yield and high radiochemical purity, the following elements in less than one minute: Te, Nb, Zr, Mo, and Sb. The second method is based on recoil in naphthalene and sublimation in a tube with a temperature gradient. This method makes possible the isolation of I and Br. Also the method based on the formation of hydrides by the action of an acid solution on zinc has been applied to the separation of Sb. These three rapid methods were used for the determination of the independent fractional or cumulative yields of the following fission products: Nb-96, Nb-97, Nb-98, Nb-99, Nb-100, Sb-127, Sb-128, Sb-129, Sb-130, Sb-131, I-134 and I-136. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N70-26595 Clemson Univ., S.C.
THE EQUATION OF MOTION FOR A PARTICLE IN AN ARBITRARY GRAVITATIONAL FIELD
Thomas Lee Ferrell (Ph.D. Thesis) 1969 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-19732

The post-geodetic equation of motion in general relativity theory is derived using the coordinate invariance of Hamilton's action principle for the gravitational field. Self-field infinities are absent in the derivation, and the final equation is completely covariant. The equation can be used with a general set of boundary conditions. Dissert. Abstr.

N70-26677# Akademiya Nauk URSR, Kiev.
THE DIFFRACTION OF SPHERICAL ACOUSTIC WAVES AT A SPHERICAL BARRIER RIGIDLY FASTENED WITH REFERENCE TO A SYSTEM OF COORDINATES
V. F. Kulko and A. F. Kharabadot *In its* Appl. Acoustics and Vibration Technol. 1968 p 9–13 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

The problem is solved for the diffraction of a spherical acoustic wave in a fluid at a barrier in the form of an absolutely rigid sphere, for the case when the radius of the sphere is larger than the wave length. The solution of the problem is obtained in closed form, using formulas which facilitate the calculations. The computation of the field is derived for several cases. Transl. by H.W.

N70-26678# Akademiya Nauk URSR, Kiev.
PROPAGATION OF PLANE WAVES IN AN INHOMOGENEOUS ONE-DIMENSIONAL MEDIUM WITH ARBITRARY DISTRIBUTION OF PARAMETERS
B. D. Tartakovskiy *In its* Appl. Acoustics and Vibration Technol. 1968 p 14–22 In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

Solutions are obtained for studies of the behavior of plane acoustic waves in layered inhomogeneous liquid media. Solutions are also included for calculating transmission of longitudinal and torsion waves along thin inhomogeneous rods. Transl. by H.W.

N70-26679# Akademiya Nauk URSR, Kiev.
SCATTERING OF A PLANE ACOUSTIC WAVE IN A THIN ELASTIC SPHERICAL SHELL
I. I. Gnatovskiy *In its* Appl. Acoustics and Vibration Technol. 1968 p 23–28 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

A plane sound wave impinges onto a thin elastic spherical shell, located in an infinite space filled with a liquid. The shell will oscillate under the effect of the inducing force. The load will be equal to the total pressure of the incident and reflected sound waves. The overall pressure in the space surrounding the shell is the sum of the pressure of the incident wave, the pressure in the wave reflected from the absolutely rigid sphere, and the pressure caused by the oscillations of the spherical shell. The scattered wave is represented as the sum of the waves, reflected from the sphere and created by the oscillations of the shell. Transl. by H.W.

N70-26683# Akademiya Nauk URSR, Kiev.
THE EFFECT OF THE TYPE OF INTERSTITIAL FLUID ON THE PROPAGATION VELOCITY OF ELASTIC WAVES IN PETROLEUM AND GAS RESERVOIRS
T. Z. Verbitskiy *In its* Appl. Acoustics and Vibration Technol. 1968 p 53–58 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

An equation is obtained for estimating the relative change in the propagation velocity of elastic waves in reservoir rock induced by a change in the interstitial fluid. Experimental data are presented which support the applicability of the formula. Transl. by H.W.

N70-26684# Akademiya Nauk URSR, Kiev.
POSSIBILITY OF USING THE ULTRASONIC METHOD FOR MEASURING THE COMPONENT CONCENTRATIONS IN THREE-COMPONENT MEDIA
V. N. Tibabishev and V. A. Ulshin *In its* Appl. Acoustics and Vibration Technol. 1968 p 59–63 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI

A method is studied for measuring the concentration of the solid component in a three-component coal pulp. The damping of the ultrasonic oscillations at various frequencies is compared. Experiments were conducted to expose the character of the ratio of the change in the damping factor to the frequency and to the concentration of the solid and air components. In the case of constant screen composition of the solid, by simultaneously measuring the damping at two different ultrasonic frequencies, differentiated tests of the concentration of both the solid and gaseous components can be obtained. Transl. by H.W.

N70-26736# Brown Univ., Providence, R.I.
ON THE INTERPRETATION OF MEASUREMENT WITHIN THE QUANTUM THEORY
Leon N. Cooper and Deborah Van Vechten 1970 22 p refs
(AD-700781) Avail: CFSTI CSCL 20/10

An interpretation of the process of measurement is proposed which can be placed wholly within the quantum theory. The entire system including the apparatus and even the mind of the observer can be considered to develop according to the Schrodinger equation. No separation in principle of the observer and the observed is necessary; nor is it necessary to introduce the type I process of von Neumann or wave function reduction. Author (TAB)

N70-27162# RAND Corp., Santa Monica, Calif.
LORENTZ INVARIANCE IN A GRAVITATIONAL FIELD
Robert L. Kirkwood Jan. 1970 22 p refs
(AD-700651; P4290) Avail: CFSTI CSCL 20/10

In any theory of gravity in which free particles move along the geodesics of a four-dimensional metric tensor, a particular class of metrics can be defined which correspond to the fields of Newtons theory of gravity. In these Newtonian fields the metric coefficients which describe intrinsic properties of space and time are clearly separated from those that describe the gravitational field. This separation suggests an invariance in the gravitational field which is quite similar to the usual Lorentz invariance of electromagnetism. The infinitesimal form of the generalized Lorentz transformation is determined by the fact that the three-dimensional geometry remains Euclidean under the transformation. The finite form is determined so that the transformations form a group, and the group is found to be the usual Lorentz group. The transformation is then applied to fields that are not necessarily Newtonian. Author (TAB)

N70-27219# Syracuse Univ., N.Y. Dept. of Physics.
ELECTROMAGNETIC MOMENTUM, ENERGY, AND MASS
F. Rohrlich Mar. 1970 22 p refs Supported in part by NSF
Submitted for publication
Avail: Issuing Activity

Electromagnetic systems of finite mass ($m>0$) and of zero mass ($m=0$) are considered. For both cases the electromagnetic energy and momentum are computed and are shown to lead to essentially different formulas. An invarient expression for the electromagnetic mass in $m>0$ systems is derived. All $m>0$ results are then specialized to the electrostatic case. Historical and present day confusion in the literature is discussed. Author

N70-27223 National Lending Library for Science and Technology, Boston Spa (England).
AMPLIFICATION OF ULTRASHORT PULSES IN A TWO COMPONENT MEDIUM
N. G. Basov et al Jan. 1970 6 p refs Transl. into ENGLISH from ZhETF Letters (Moscow), v. 10, 20 Nov. 1969 p 479–482
(NLL-CT4/702-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

A non-self-exciting amplification system was developed which produces a train of ultrashort light pulses of 18 J total energy and with 1 J energy of a single pulse. The system consists of an amplifying medium and a dense nonlinear absorber in an annular system. The laser pulse is isolated with the nonlinear absorber, passed through a saturable dye and introduced into the annular system. The amplifying medium consists of two 1 m neodymium glass rods placed on either side of a polymethane dye. The input and amplified pulses are recorded on an oscilloscope, and the total energy is measured simultaneously. N.E.N.

N70-27352# Massachusetts Univ., Amherst. School of Engineering.
A PRELIMINARY STUDY OF THE APPLICATION OF SPINNING MODE THEORY TO THE SUBMERSIBLE VEHICLE PROPELLER
W. J. Webster Oct. 1969 23 p refs
(Contract N00014-68-A-0146-1316)
(AD-701785; THEMIS-UM-69-7) Avail: CFSTI CSCL 13/10

By enclosing the propeller of a submersible vehicle in a rigid cylindrical duct it is possible to exercise control over the discrete frequency noise produced. The applicable portions of spinning mode theory are reviewed and its application to submersible vehicles is illustrated with numerical examples. Author (TAB)

N70-27493# Defense Documentation Center, Arlington, Va.
XENON LAMPS, VOLUME 1 BIBLIOGRAPHY, NOV. 1958–OCT. 1969
Mar. 1970 102 p refs
(AD-702725; DDC-TAS-70-23-Vol-1) Avail: CFSTI CSCL 13/1

The bibliography contains annotated references dealing with illuminants equipped with powerful xenon lamps, a satellite-borne xenon flash optical beacon for use on the proposed missile range calibration, development of infrared sources, ocular effects of thermal radiation, spectral flash lamps, and optical pumps for lasers. Its use as thermal energy is also discussed. Author (TAB)

N70-27535*# Translation Consultants, Ltd., Arlington, Va.
PROPERTIES OF INERTIAL-GRAVITATIONAL FIELDS [O SVOYSTVAKH INERTSIALNO-GRAVITATSIONNYKH POLEY]
L. D. Raygorodskiy Washington NASA Apr. 1970 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz (Tomsk), no. 7 (86), 1969 p 97–103
(Contract NASw-2038)
(NASA-TT-F-12970) Avail: CFSTI CSCL 20C

The analysis made of certain of the properties of inertial-gravitational fields described by the Maxwell type equations reveals that the term inertial-gravitational field is understood to mean a physical situation differing, in the general case, from what one has in mind when only real gravitational fields described by the equations of the general theory of relativity are considered. A significant, special feature of the inertial-gravitational field is that its potentials determine the field of the four vector speed of test particles. Author

N70-27642*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
AN ANALYSIS OF THE NOISE REDUCTION OF ORTHOTROPIC CYLINDRICAL SHELLS Final Report
E. K. Bender 3 Apr. 1969 21 p refs
(Contract NAS8-20026)
(NASA-CR-102665; Rept-1775) Avail: CFSTI CSCL 20A

The equations for the noise reduction by an orthotropic

cylindrical shell are presented. Statistical energy methods (for resonant mode transmission) and classical methods (for non-resonant mode transmission) are used to estimate the acoustic power flow from a diffuse external noise field to the internal frequency ranges, showing that noise reduction will be small for frequencies below the ring frequency and above the highest critical frequency. Between the ring frequency and the lowest critical frequency noise reduction is high and is moderate for frequencies between the lowest and highest critical frequency. Author

N70-27795 National Lending Library for Science and Technology, Boston Spa (England).
THEORY OF CONICAL CENTRIFUGES [K TEORII KONICHESKIKH TSENTRIFUG]
G. A. Saburdo Feb. 1970 9 p refs Transl. into ENGLISH from Tr. Kievsk. Tekhnol. Inst. Pishchevoi Prom. (Kiev), no. 19, 1958 p 173–176
(NLL-RTS-5567) Avail: Natl. Lending Library, Boston Spa, Engl.: 10s or 1 NLL photocopy coupon

A formula for determining the travel of a particle as a function of time and gravitational effects is derived for a constant motion conical centrifuge. With the formula, the speed of the particles of material and the dependency upon the position of drum can be determined directly. The length of time the particles are present within the drum, or the duration of individual operations are expressed by a formula, which enables determinations of the required dimensions of the drum and its zone for a certain duration of the technological cycle. It was also found that, to ensure uniform movement of the particles inside, the drum generatrix must conform with a certain equation. S.S.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N70-26506# Northeastern Univ., Boston, Mass. Dept. of Physics.
A MEASUREMENT OF ELECTROPRODUCTION OF MUON PAIRS
D. R. Earles, R. C. Chase, W. L. Faissler, M. W. Gettner, G. Glass et al Feb. 1970 16 p refs
(Grant NSF GP-8351)
(NUB-1996) Avail: Issuing Activity

An experiment on electroproduction of muon pairs with invariant masses between 400 and 900 MeV is reported. The experiment, interpreted as a test of the timelike photon propagator, shows agreement with QED. Photon propagator modifications representing (+) metric and (−) metric heavy photons are limited to masses of 1260 and 750 MeV, respectively. A model used to calculate rho-QED interference yields a best rho-QED phase angle of 16 deg + or − 22 deg. Author

N70-26510 Washington Univ., Seattle.
AN EXPERIMENTAL STUDY OF NEGATIVE KAON p CHARGE EXCHANGE AT 1.8 BeV/c
Norman Dale Soosong (Ph.D. Thesis)
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 69-20274

The angular distribution in the center of mass for negative kaon proton charge exchange has been measured at an incident negative kaon beam momentum of 1.8 BeV/c (785 MeV/c in the center of mass). Scintillation and gas Cerenkov counters and optical spark chambers were used for detectors; liquid hydrogen provided the target protons. The angular distribution has been fitted to a Legendre polynomial series and the coefficients calculated. Angular moments are necessary to account for the data. A modified form of rho-exchange is found to fit the data quite well in the forward direction. Dissert. Abstr.

N70-26513 Washington Univ., Seattle.
THE WEAK DECAY PARAMETERS OF THE NEGATIVE Xi HYPERON
John William Humphrey (Ph.D. Thesis) 1969 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-20238

The decay parameters and polarization of the negative Xi hyperon produced in negative Kaon proton interactions at the laboratory momentum of 1.8 GeV/c were measured. This high statistics study used the spark chamber-counter technique. Dissert. Abstr.

N70-26514 Washington Univ., Seattle.
THE MAGNETIC MOMENT OF THE NEGATIVE Xi HYPERON
Oscar Robert Sander (Ph.D. Thesis) 1969 191 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 69-20268

The magnetic moment of the negative Xi hyperon was measured by observing the rotation of its asymmetric decay distribution in a high magnetic field. The negative Xi hyperons were produced in the reaction negative kaon + proton yields negative Xi hyperon + positive kaon at an incident negative kaon meson momentum of 1.8 BeV/c. A series of counters and optical spark chambers were used to detect each event. A sample of 1476 events yields a magnetic moment of −0.1 + or − 2.1 nuclear magnetons. A sample of 957 events yields an asymmetry parameter of −0.052 + or − 0.032 in the center of mass production angle interval between 20 and 80 deg. Dissert. Abstr.

N70-26515 Stevens Inst. of Tech., Hoboken, N.J.
ANALYSIS OF 15865 Tau(+) DECAYS AT REST
Joseph Uri Grauman (Ph.D. Thesis) 1969 53 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-21290

The energy spectrum of the like and unlike pions in Tau(+) decay were obtained from a sample of 15,865 events. The spectrum of the difference of like-pion energies is found to be adequately fitted by a zero-slope line. No evidence for CP noninvariance is found for Tau(+) decays. A significant violation of the change in I = 1/2 rule is observed for kaon(+) yields 3 pion decays. Comparison with several theoretical models for kaon yields 3 pion decays shows fair agreement between experiment and theory. Dissert. Abstr.

N70-26516 Colorado Univ., Denver.
THE DEUTERON AMPLITUDES FROM A COMPOSITE PARTICLE NUCLEAR SCATTERING THEORY
Temple Ferris Smith (Ph.D. Thesis) 1969 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-19572

The problem of obtaining the scattering amplitudes of deuterons from nuclei is studied through a series expansion, in two-body transition amplitudes, of the three-body problem by means of the Faddeev equations. The interaction between the nucleons of the deuteron and the nucleus are assumed to be described by the optical model potential obtained phenomenologically from elastic scattering data. Thus from the more elementary nucleon scattering, the deuteron scattering amplitudes are obtained. As in all multi-body calculations, the two-body transition amplitudes are needed as a function of the propagator energy both on and off the

energy shell. In an effort to obtain these amplitudes, a general method of calculating the two-body amplitudes was obtained which involved solving an inhomogeneous differential equation, rather than the usual Lippmann-Schwinger integral equation. Dissert. Abstr.

N70-26517# Pittsburgh Univ., Pa. Dept. of Physics.
HIGH-ENERGY PHYSICS AT THE UNIVERSITY OF PITTSBURGH Progress Report, 1 Dec. 1968 – 1 Dec. 1969
Richard H. Pratt Nov. 1969 24 p refs
(Contract AT(30-1)-3829)
(NYO-3829-42) Avail: CFSTI

A progress report is presented on research in theoretical high-energy physics at the University of Pittsburgh. The research is briefly summarized, and publications issued during the period are listed. NSA

N70-26524 Yeshiva Univ., New York.
A MODIFIED HARD SPHERE APPROACH TO BINARY FLUIDS
David Alan Zomick (Ph.D. Thesis) 1969 94 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-21026

A fluid model in which the system is approximated by a binary mixture of hard spheres with non-additive radii is investigated. An exact equation of state and expressions for the correlation functions are examined in both one and three dimensions. The solutions are found to be considerably more complicated than for the case of additive diameters and are no longer exact, even in one dimension. Properties of the solutions and applications are discussed. Dissert. Abstr.

N70-26530# European Atomic Energy Community, Geel (Belgium). Joint Nuclear Research Center.
DATA REDUCTION PROGRAMS FOR TOTAL CROSS SECTION EXPERIMENTS
G. Nastri and H. Schmid Brussels 1970 62 p refs
(EUR-4456.E) Avail: CFSTI

The present set of data reduction programs (FORTRAN 4, IBM 1800 computer) calculates the transmission and the total neutron cross section for time-of-flight measurements. Dead time and background corrections are performed and the statistical fluctuations of the experimental spectrum for the open beam are eliminated. The reduced data can be plotted. Author

N70-26532 State Univ. of New York at Buffalo.
MAGNETIC QUADRUPOLE POLARIZABILITY OF CLOSED-SHELL ATOMS AND IONS
Hugo S. Radt, Jr. (Ph.D. Thesis) 1969 139 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-20589

The magnetic quadrupole polarizability tensor, which relates the induced quadrupole moment of an atomic system to the components of the external magnetic field gradient, is defined and simplified for the case of spherically symmetric systems in an axially symmetric external field. General expressions are presented for the electric scalar and magnetic vector potentials, corresponding to the first three terms of Taylor-series expansions for the electric and magnetic field vectors. The Hamiltonian operator is obtained for a many-electron atom in simultaneous axially symmetric electric and magnetic fields with first-order gradients. Expressions are then derived for the Hartree–Fock approximation to the energy, perturbed to second-order in the magnetic field gradient, for an axisymmetric external field and for closed-shell atoms or ions. Calculations of the magnetic quadrupole polarizability are performed by the above method for closed-shell atoms and ions with two to eighteen electrons. The calculations show a rapid decrease with atomic number within each series. Dissert. Abstr.

N70-26534 Brandeis Univ., Waltham, Mass.
NEUTRON-PROTON MASS DIFFERENCE BY AN S-MATRIX METHOD
Lance Kenneth Heiko (Ph.D. Thesis) 1969 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-20726

The neutron-proton mass difference is calculated in the framework of the bootstrap theory of symmetry-breaking. An S-Matrix perturbation method that is both static and cutoff dependent is derived. The method permits both mass and residue shifts to enter into calculations. In the calculation of the neutron-proton mass difference the feedback of mass and residue shifts is capable of reversing the negative contribution of one photon exchange. The mass difference, however, cannot be accounted for in terms of mass shift feedback alone. The reduction factors for Delta exchange which are necessary to obtain the mass difference are discussed in detail. Dissert. Abstr.

N70-26536 West Virginia Univ., Morgantown.
NEUTRON INDUCED REACTIONS BETWEEN 14.4 AND 16.7 Mev
Irvin Garrett Clator (Ph.D. Thesis) 1969 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-20703

Neutron induced reactions with some medium atomic weight nuclei were studied for incident neutron energy between 14.4 and 16.7 Mev, and the results compared to the statistical model predictions. The reactions studied were: Mg24(n,p)Na24; Cr52(n,p)V52; Cu65(n,p)Ni65; Zn66(n,p)Cu66; Zn68(n,p)Cu66; Cu65(n,alpha)Co62g; and Cu65(n,2n)Cu64. The method of neutron activation was used. A pneumatic transfer system was used to shuttle the samples between the flux and detectors, and both a NaI(Tl) detector and a Ge(Li) detector were used in the gamma counting. The Zn(n,p) and Cu(n,alpha) excitation functions are reported for the first time. The results obtained, at 14.4, 15.7, 16.7 Mev, are listed. Dissert. Abstr.

N70-26539# Daresbury Nuclear Physics Lab. (England).
USE OF INTERACTIVE COMPUTER GRAPHICS IN HIGH ENERGY PHYSICS
A. Y. Chau, B. W. Davies, P. M. Richmond, and B. Zacharov Aug. 1969 10 p refs Held at the Conf. on Computational Phys., Culham, England
(DNPL/P-16; CONF-690706-2) Avail: AEC Depository Libraries

It is pointed out that many computing problems in high energy physics can profitably be solved by iterative procedures. Illustrations of the use of computer graphics in this field are given by reference to studies in progress at DNPL. Applications include the design of magnet systems for beam optics configurations, with particular regard to magnet spectrometers; the display of ambiguous events in spark chamber experiments; the creation, examination, and manipulation of statistical aggregates arising from experimental data; aid for varying the parameters of a mathematical function superimposed on a display of experimental data. Comments are made on user experience and an indication is given of the reduction in overall time which has been achieved by the introduction of interactive graphics. NSA

N70-26578 Wisconsin Univ., Madison.
STRANGE PARTICLE PRODUCTION IN 25 GeV/c NEGATIVE PION-PROTON INTERACTIONS
James Wayne Waters (Ph.D. Thesis) 1969 274 p
Avail: Univ. Microfilms: HC $12.40/Microfilm $3.55 Order No. 69-12430

Various features of strange particle production were examined. Such production is highly multiple, with average multiplicity of all secondaries approximately 7 - 8. The two-body mass spectra from all final states are in remarkable qualitative agreement with those

obtained at lower energies in low multiplicity final states. A noticeable characteristic of these events is the production of numerous mesons slow in the center of mass. Hyperons are emitted preferentially backward in the center of mass with about 25% emitted forward. No evidence for two fireball production can be given, although the possibility of such production can not be excluded. The values of the average transverse momentum, for various particles were obtained. These are found to increase with the mass of the particles, but particles of the same mass can have different values. Dissert. Abstr.

N70-26577 Michigan State Univ., East Lansing.
A STUDY OF THE PRODUCTION AND DECAY OF RESONANT STATES IN PERIPHERAL HIGH ENERGY COLLISIONS
Glenn Thomas Williamson (Ph.D. Thesis) 1969 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-20956

The current theoretical situation in phenomenological analysis of high energy scattering is reviewed. Various attempts are made to improve upon several models. In particular, the form factor effects and Regge treatment of Born amplitude propagators are examined. Higher order exchange contributions are considered as possible solutions to the problem of energy dependence of higher spin exchange amplitudes. It is found that a combination of the absorptive peripheral model and the Regge pole model is the most successful approach, in that energy dependence difficulties are eliminated as in the need for conspiring trajectories. Dissert. Abstr.

N70-26578 Polytechnic Inst. of Brooklyn, N.Y.
KAON AND PION CHARGE RADII AND THE MAGNETIC MOMENTS OF RHO AND K* MESONS FROM SIDEWISE DISPERSION RELATIONS
Tat Shong Tan (Ph.D. Thesis) 1969 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order no. 69-20377

The charge radius of the charged kaon is calculated from the sidewise dispersion relation. The absorptive part in this approach is related to the kaon-pion interaction amplitudes. The intermediate states are approximated by two particle states of vector mesons and scalar mesons. The absorptive part for the kaon-photon vertex is related to the VPP vertices and the photoproduction of vector mesons from two scalar mesons. The latter amplitudes are obtained by pole dominance and guage invariance condition, and depend on the magnetic moments of the vector mesons. The absorptive part also depends on these magnetic moments. Dissert. Abstr.

N70-26579 Colorado Univ., Boulder.
A STUDY OF BARYON RESONANCES OBSERVED IN THE TWO CHARGED PARTICLE FINAL STATES FROM 2.36 GeV/c PION-PROTON INTERACTIONS
John Richard Wilson, Jr. (Ph.D. Thesis) 1969 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-19582

Baryon isobars formed in 24,000 events when negative pions of momentum 2.36 GeV/c were incident on a 72 inch hydrogen bubble chamber were studied. The purpose was to derive cross sections for the processes, and to attempt to discover the mechanisms of production and decay. Isobars were observed in three states. The Delta (+) state is formed in the presence of high background, apparently by rho exchange. A method of extracting the signal from the background is presented. Using this signal extraction method, the decay ratio of Delta (+) proton and neutron channels agrees roughly with estimates from isotopic spin conservation in the decay process. Dissert. Abstr.

N70-26586# Brookhaven National Lab., Upton, N.Y.
EXPERIMENTAL TESTS OF (RHO, A2) AND (K*, K) EXCHANGE DEGENERACY IN FORWARD MESON-BARYON SCATTERING**
Kwan Wu Lai and James Louie [1969] 39 p refs Presented at the Regge-pole Conf., Irvine, Calif., 5-6 Dec. 1969
(BNL-14222; CONF-691202-1) Avail: CFSTI

The idea of exchange degeneracy of vector and tensor meson Regge trajectories is investigated experimentally for several pairs of reactions related by reverse s-u crossing. Author (NSA)

N70-26588# Syracuse Univ., N.Y. Dept. of Physics.
A VENEZIANO MODEL FOR THE REACTION PI-P YIELDS ETAN
Maurice L. Blackmon and Kameshwar C. Wali Nov. 1969 14 p refs Sponsored by AEC
(SU-1206-215; NYO-3399-215) Avail: CFSTI

A Veneziano model is proposed for the reaction negative pion proton yields eta-meson neutron. This reaction is interesting since only the twin meson trajectory can contribute in the t-channel, and only T = 1/2 trajectories appear in the s- and u-channels. The terms in this model are limited to those which have leading asymptotic behavior in two channels. The intimate connection between resonance parameters and both forward and backward cross sections is emphasized. Author (NSA)

N70-26589# Chicago Univ., Ill. Dept. of Physics.
PHENOMENOLOGICAL LAGRANGIAN MODEL CHIRAL SU(3) x SU(3) FOR MESONS AND BARYONS
Yuk-Ming P. Lam and Yee Yen Lee Oct. 1969 28 p refs
(Contract AT(11-1)-264)
(COO-264-527; EFI-69-94) Avail: CFSTI

Using the techniques of nonlinear realization of SU(3) x SU(3), a Lagrangian is written for the pseudoscalar nonet and 1/2(+) baryon octet with a symmetry breaking term transforming like a vector in a (3,3*), by (3*,3) representation of SU(3) x SU(3). This Lagrangian yields a mass formula (different from the Gell-Mann-Okubo mass formula) for the pseudoscalar octet, and if we neglect eta-eta prime mixing, then this formula fits the experimental masses to an accuracy of about 1 MeV. From this Lagrangian, explicit expressions of the axial vector currents in terms of particle fields are obtained. The tree-diagram prescription then yields a modified Goldberger-Treiman relation consistent with experimental measurements. Author (NSA)

N70-26608# Akademiya Nauk SSSR, Moscow. Inst. Atomnoi Energii.
ANALYSIS OF NEUTRON FISSION OF Th-232 NEAR THE THRESHOLD
P. E. Vorotnikov 1969 27 p refs In RUSSIAN
(IAE-1806) Avail: AEC Depository Libraries

Results are given for the neutron fission channel of Th-232 near the threshold, which indicate that quasistationary states of the fissioning nuclei play an important role in the process; fission barriers for states having different K are shifted with respect to each other by a value proportional to K squared; the distribution with respect to K of states with given total moments I is nonuniform, and small values of K have greater probability. Quasistable states also affect the probability of nonelastic scattering of neutrons. The dependence of the number of neutrons and kinetic energy of particles on the excitation energy agrees with assumptions made concerning nuclear octupole deformation in the quasistable state. Author (NSA)

N70-26609# California Univ., Berkeley. Lawrence Radiation Lab.
A SIGMA (n,2n) COMPUTER CODE FOR 14.5 MeV NEUTRONS
A. Gilbert and R. Gomberg 3 Oct. 1969 50 p
(Contract W-7405-eng-48)
(UCRL-50736) Avail: CFSTI

The statistical model is used to calculate (n,2n) cross sections. In these calculations, an attempt is made to compensate for the existence of discrete states by using effective thresholds. Author (NSA)

N70-26611# Chicago Univ., Ill.
THEORETICAL RESEARCH IN ELEMENTARY PARTICLE PHYSICS Technical Progress Report
Dec. 1969 22 p refs
(Contract AT(11-1)-264)
(COO-264-532) Avail: CFSTI

A progress report is presented on elementary particle theoretical research at the University of Chicago from December, 1968 to December, 1969. Brief synopses of this research and a list of publications issued are given. NSA

N70-26615 Polytechnic Inst. of Brooklyn, N.Y.
EFFECTS OF VERY HIGH ELECTRIC FIELDS ON ATOMIC AND MOLECULAR STRUCTURES WITH APPLICATIONS TO FIELD EMISSION FROM ADSORBED MOLECULES
Alphonse Joseph Sistino (Ph.D. Thesis) 1969 136 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-20368

A series of calculations was carried out to determine the various distortions of extremely high electric fields on the H-atom, the H2 molecule, and a simple model triatomic molecule adsorbed on a metal surface. The high field energy and susceptibility of H are determined using a variational wave function including dipolar distortion, up to field ionization. With similar wave functions the energy, interatomic spacing and vibrational characteristics of H2 are found in high fields. The spacing increases and the bonding force decreases with field until the molecule dissociates. Using these results, the energy, orientation, and vibrational modes of a model linear triatomic molecule adsorbed on a metal surface are investigated. The combination of Van der Waals and polarization energies produces two energy minima, with the molecule either parallel or perpendicular to the surface. At the highest fields, the latter is the most stable orientation. Dissert. Abstr.

N70-26623# California Univ., Berkeley. Lawrence Radiation Lab.
SPECTROSCOPIC INFORMATION FROM HEAVY-ION REACTIONS
F. S. Stephens Aug. 1969 32 p refs Held at the Intern. Conf. on Properties of Nucl. States, Montreal
(Contract W-7405-eng-48)
(UCRL-18964) Avail: CFSTI

The general subject of spectroscopic studies following heavy-ion reactions is briefly outlined, followed by a more detailed evaluation of the (HI,xn) reactions for such studies. This type of reaction provides a unique opportunity for the systematic study of high angular momentum states. Examples of the types of spectroscopic information obtained using (HI,xn) reactions are presented. Author (NSA)

N70-26625# California Univ., Berkeley. Lawrence Radiation Lab.
ENERGY AND FLUX DETERMINATIONS OF HIGH-ENERGY NUCLEONS
Harold A. Wollenberg and Alan R. Smith Aug. 1969 12 p refs Presented at the Intern. Conf. on Accelerator Dosimetry and Experience, Stanford, Calif., 5-7 Nov. 1969
(Contract W-7405-eng-48)
(UCRL-19364; CONF-691101-12) Avail: CFSTI

The fission track method is used to determine the energy and flux of neutrons and protons in the energy range above 50 to 100 MeV. Foils of U, Bi, Au, and Ta together with muscovite mica track detectors are exposed to nucleons of unknown high energy and flux. The effective energy of these nucleons is determined by comparing ratios of fission rack densities of various targets with calibration curves of energy versus track-density ratio. Knowing the effective energy, one can then select the appropriate cross section from experimentally determined cross-section curves, and can then determine an effective nucleon flux for the exposure conditions. This technique was tested using data from an experiment at the CERN P.S.; results were in good agreement with those from measurements of C-11 activity in plastic scintillators exposed under the same conditions. Author (NSA)

N70-26630# Institute of Nuclear Sciences, Lower Hutt (New Zealand).
[RESEARCH AND DEVELOPMENT PROJECTS] Progress Report, Jan.–Jun. 1968
Jun. 1968 45 p refs
(INS-343) Avail: AEC Depository Libraries

Research and development projects are briefly outlined in instrumentation, nuclear physics, radiation research isotope geochemistry (stable isotopes), radioactive dating and radioactive fallout, and isotope applications. NSA

N70-26636# Bonn Univ. (West Germany). Inst. fuer Strahlen und Kernphysik.
NUCLEAR SPECTROSCOPY WITH THE (HE3, ALPHA) REACTION [KERNSPEKTROSKOPIE MIT DER (HE3, ALPHA) REAKTION]
P. David Mar. 1969 164 p refs In GERMAN
(BMwF-FBK-69-7) Avail: AEC Depository Libraries

The DWBA methods are re-examined for the (He-3,alpha)-reaction. It is found that the use of the (He-3,alpha)-reaction as a spectroscopic tool is limited by the angular momentum mismatch. The exact matrix-element of the distorted wave theory indicates that the alpha-potential should be roughly equal to the sum of the He-3 and (bound)-neutron potentials. The effects of non-locality and finite range are discussed. The influence of spin-orbit coupling on the angular distributions and the absolute cross-sections are investigated. The absolute normalization factor of the DWBA-cross section derived from the analysis of the data agrees with theoretical predictions. The bound state wave functions for configurational and analog states are discussed. Author (NSA)

N70-26645# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
ELECTROMAGNETIC MASS DIFFERENCE OF ZERO MASS PIONS: THE 4TH ORDER
Ira S. Gerstein, Howard J. Schnitzer (Brandeis Univ.), Tang-Fong Wong (Brown Univ.), and G. S. Guralnik (Brown Univ.) Nov. 1969 37 p refs Revised
(Contracts AT(30-1)-2098; AT(30-1)-3178)
(NYO-2262-TA-198(Rev.)) Avail: CFSTI

The fourth-order contribution to the electromagnetic mass difference of zero-mass pions is considered in a model whose high-energy behavior is that given by algebras of fields commutation relations. It is found that this quantity is logarithmically divergent. Possible sources of this divergence are discussed. Author (NSA)

N70-26646# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PACIFIC NORTHWEST LABORATORY DIVISION OF ISOTOPE DEVELOPMENT PROGRAMS Quarterly Report, Aug. – Oct. 1969
W. F. Sheely Nov. 1969 40 p refs
(Contract AT(45-1)-1830)
(BNWL-1256) Avail: CFSTI

The promethium compatibility work is continuing. A study was made of the possibility of producing 5 MCi of encapsulated cesium sources. The circuit design for the multi-element transducer concept is continuing. The scan logic, gates, preamplifier, and readout circuitry are presently undergoing development. A boron carbide/epoxy resin compound was found to be the most effective neutron shield of the candidate materials for a thermal neutron radiography camera. A basic camera design has been formulated and a prototype constructed. Sputtering parameters have been investigated using cold materials in preparation for sputter-deposition and sputter-coating alpha sources. Comparisons have been made of the relative costs of Pu-238 produced by Np target irradiation in power or in flux reactors. A survey of potential reactor fuel reprocessors indicate that neptunium recovery facilities will be available soon. Neutron fluence and doses were calculated at axial and radial positions from a Pu-238 source in a right circular tissue-equivalent phantom. NSA

N70-26647# Oak Ridge National Lab., Tenn.
ANALYTICAL DESCRIPTION OF THE NEUTRON CROSS SECTIONS OF U-233 BELOW 60 eV
Gerard de Saussure 5 Nov. 1969 32 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2745) Avail: CFSTI

The neutron fission and capture cross sections of U-233 below 60 eV were least-square fitted with the Adler and Adler multilevel formalism. The physical interpretation of the resonance parameters is ambiguous because such multilevel fits on U-233 are not unique. The main purpose of the analysis was to provide a simple analytical description of the U-233 cross sections for use in calculating reactor reaction rates and in data evaluation. The fission, capture and total cross sections and the values of eta obtained from the resonance parameters are compared with recent measurements of those quantities. Author (NSA)

N70-26648# California Univ., Berkeley. Lawrence Radiation Lab.
MATHEMATICAL CONSIDERATIONS OF DETERMINING NEUTRON SPECTRA FROM ACTIVATION MEASUREMENTS
Jorma T. Routti Aug. 1969 26 p refs Held at the 2nd Intern. Conf. on Accelerator Dosimetry and Experience, Stanford, Calif.
(Contract W-7405-eng-48)
(UCRL-19375; CONF-691101-8) Avail: CFSTI

Several techniques of high-energy neutron spectroscopy, like those using activation detectors, moderating spheres, and nuclear emulsions, require a mathematical unfolding procedure to obtain the neutron energy spectrum from a set of measured data. The general requirements for a solution method as well as tests to study how well these requirements are met are discussed. The solution method has to be able to combine the information contained in the measured data with available prior knowledge of the neutron spectrum. Otherwise complications like nonuniqueness, oscillatory and negative character of the solution, are likely to arise. The commonly used solution techniques are reviewed and their applicability to high-energy neutron spectroscopy is discussed. The resolution obtainable for the neutron spectrum, although limited by the mathematical nature of the problem, is in most cases sufficient to be useful in problems of shielding design and operational safety. Author (NSA)

N70-26672# Princeton-Pennsylvania Accelerator, Princeton, N.J.
DEUTERON-DEUTERON INTERACTIONS AT SIX LABORATORY MOMENTA FROM 680 TO 2120 MeV/c
A. T. Goshaw, P. J. Oddone, M. J. Bazin, and C. R. Suun 27 Aug. 1969 17 p refs
(Contract AT(30-1)-2137)
(PPAR-18) Avail: CFSTI

The elastic and total cross sections for deuteron-deuteron interactions at 680, 920, 1180, 1500, 1750, and 2120 MeV/c are presented. The data are compared with theoretical calculations and shown to be in qualitative agreement with predictions based on the Glauber multiple scattering formalism. In particular the existence of large angle deuteron-deuteron elastic scattering provides evidence for simultaneous scattering amplitudes predicted by the Glauber theory. Author (NSA)

N70-26673# Gottingen Univ. (West Germany). Inst. fuer Medizinische Physik und Biophysik.
PREFERENTIAL RECOMBINATION IN GASES AT HIGH PRESSURE [ZUR BEVORZUGTEN REKOMBINATION VON LONEN IN GASEN UNTER HOHEM DRUCK]
R. Koepp Jun. 1969 46 p refs In GERMAN
(BMwF-FBK-69-18) Avail: AEC Depository Libraries

The effect of high pressure (200 atm) on the preferential recombination of ions in the irradiated gases oxygen nitrogen, synthetic air, helium, and argon has been studied. The results indicate that attachment of electrons is no important precondition for preferential recombination since oxygen and air are showing the same proportion and nitrogen a reasonable amount of preferential recombination. In the rare gases helium and argon there has not been found any preferential recombination, as expected. Author (NSA)

N70-26674# Florida State Univ., Tallahassee. Dept. of Physics.
ELEMENTARY PARTICLE PHYSICS AT FLORIDA STATE UNIVERSITY Progress Report, 1 Nov. 1968 – 31 Oct. 1969
J. E. Lannutti, J. R. Albright, A. P. Colleraine, J. P. Chandler, G. Yost et al 20 Dec. 1969 19 p
(Contract AT(40-1)-3509)
(TID-25298) Avail: CFSTI

Theoretical and experimental research on high-energy physics at the University of Florida from Nov. 1968 to Oct. 1969 is summarized. Publications issued during the period are also listed. NSA

N70-26675# Maryland Univ., College Park. Dept. of Physics and Astronomy.
EVENT WEIGHTING AND CROSS-SECTIONS FOR THE 2.9 GeV/c NEGATIVE KAON PROTON EXPERIMENT Technical Report
R. J. Hemingway and H. Whiteside Nov. 1969 46 p refs
(Contract AT(40-1)-2504)
(ORO-2504-148; TR-70-065) Avail: CFSTI

A weighting procedure is applied to the hot events of the 2.9 GeV/c negative kaon proton experiment to make a first-order correction for losses due to finite bubble chamber size, reduced efficiency in the detection of short decays and reduced efficiency in the detection of small angle kinks. The method is described in detail and pertinent particle distributions are presented. With due consideration of scanning efficiency, visibility factors, kinematic ambiguity and beam impurity, the cross sections of the many final states may be determined. Author (NSA)

N70-26709# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
RELATIVISTIC SCHROEDINGER EQUATION FOR A PARTICLE WITH ARBITRARY SPIN, PART 2

Nicholas J. Ionesco-Pallas 1969 18 p refs
(IFA-FT-75) Avail: AEC Depository Libraries

The relativistic Schroedinger equation formerly derived by the author is generalized in order to include simultaneously vectorial, scalar, pseudo-vectorial, and pseudo-scalar interactions, without leaving the irreducible (2S+1) representation. For this purpose, a new approach to the theory, which deals with bilinear forms and the Lagrange function is adopted. Poincare algebra and, consequently, the classical integrals of motion may be easily obtained by going over to the 2(2S+1) dimensionality. The possibility of nonlinear extension of the wave equation is investigated as well. Finally, it is pointed out that the relativistic and probabilistic quantum mechanics for a particle with arbitrary spin would be possible without using redundant components, if the gyromagnetic ratio g is assumed g = 2, irrespecitve of spin and interation. Author (NSA)

N70-26718# Brookhaven National Lab., Upton, N.Y.
PRODUCTION OF RADIOISOTOPES BY SPALLATION
L. G. Stang, Jr., M. Hillman, and E. Lebowitz Aug. 1969 166 p refs
(BNL-50195) Avail: CFSTI

In an attempt to provide a practical basis for planning to produce radioisotopes by spallation extensive tabulations of calculated yields of products from virtually every possible target element bombarded by 200-MeV protons are given. In addition, the effects of bombarding energy and choice of target on product yield are examined. Several advantages of the spallation process relative to fission are enumerated. NSA

N70-26721# Atomic Energy Centre, Dacca (Pakistan).
RELATIVISTIC TABLES OF NEUTRON ENERGIES FROM T(P,N), D(D,N), T(D,N) AND LI(P,N) REACTIONS
Muhtasham Hussain (Dacca Univ.) and Enayet M. Ullah Feb. 1969 84 p refs
(AECD/EP-17) Avail: AEC Depository Libraries

Relativistic tables of neutron energies have been prepared for T(p,n), D(d,n), and Li(p,n) reactions. They give energies in steps of 10 keV of projectile energy for neutrons emitted at various angles. The tables are limited to a maximum energy of 3 MeV for the bombarding particles. Author (NSA)

N70-26723# Syracuse Univ., N.Y. Dept. of Physics.
UNIVERSAL THEORY OF PRIMARY INTERACTIONS, SCALAR MESONS, AND NUCLEON-NUCLEON SCATTERING
C. C. Chiang (Texas Univ.), R. J. Gleiser, and M. Huq (Atomic Energy Centre, Dacca, East Pakistan) Nov. 1969 32 p refs Sponsored in part by AEC
(SU-1206-216; NYO-3399-216) Avail: CFSTI

The nucleon-nucleon phase shifts are calculated by adding the exchange of the scalar isoscalar meson epsilon to previous calculations based on the universal theory of primary interactions proposed previously. Some improvements are obtained. Author (NSA)

N70-26724# Syracuse Univ., N.Y. Dept. of Physics.
REGGE-POLE EIKONAL THEORY FOR SMALL-ANGLE NUCLEON-NUCLEON AND ANTINUCLEON-NUCLEON SCATTERING
Maurice L. Blackmon and Gary R. Goldstein (Tufts Univ.) Oct. 1969 25 p refs Sponsored by AEC
(SU-1206-211; NYO-3399-211) Avail: CFSTI

An eikonal model is presented for the small-angle, high-energy scattering of nucleons and antinucleons on nucleon targets. The model uses a flat Pomeranchon with a residue function given by a squared dipole. Also exchange degenerate trajectories and residue functions are used for the three pairs of Regge poles (the omega meson and P'.) the (rho meson and A sub 2 and the pion and B). Using previous work to fix trajectories and relative sizes of residue functions, it is found that the model describes elastic processes satisfactorily. Differential cross sections and polarizations are calculated. Also the charge exchange reactions nucleon-proton yields proton-nucleon and antiproton-proton yields antinucleon-nucleon are discussed. Author (NSA)

N70-26731# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
FAST AND RESONANCE NEUTRON SPECTRUM IN WATER AND GRAPHITE
I. Grancea, V. Cuculeanu, and V. Isoif 1969 12 p refs
(IFA-FR-77) Avail: AEC Depository Libraries

Fast neutron spectra in water and graphite were measured using threshold detectors. The resonance neutron spectra were measured by another method. NSA

N70-26748 Colorado Univ., Boulder.
THEORY OF PRESSURE BROADENING FOR ISOLATED AND OVERLAPPING SPECTRAL LINES WITH A CALCULATION OF THE 60 GHZ OXYGEN LINES
Thomas Andrew Dillon (Ph.D. Thesis) 1969 137 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-19527

The problem of pressure broadening for spectral lines in gases is formulated in the Liouville operator representation. The classical path theory of overlapping lines was used to calculate the line shape of the O2 spectrum near 60 GHz. The dispersion and exchange terms in the intermolecular potential were used to calculate the broadening. Matrix elements of the scattering operator were calculated from the full exponential representation of the sudden approximation rather than using the first few terms of a series expansion. Since classical trajectories determined by the monopole interaction terms were used instead of straight paths, an arbitrary cutoff for the integration over impact parameters was not needed. Good agreement with the magnitude, N quantum number dependence and temperature dependence of existing experimental linewidth data is obtained with one adjustable parameter. In fact, the value of this parameter predicted by a simple theory of dispersion forces gives the best agreement. Dissert. Abstr.

N70-26777# United Nuclear Corp., Elmsford, N.Y. Research and Engineering Center.
MODIFICATION OF UNC-SAM-2 TO UNC-SAM-3 Final Report
E. S. Troubetzkoy Jan. 1970 26 p
(Contract DASA01-69-C-0021)
(AD-701758; UNC-5157-Suppl-1; DASA-2338) Avail: CFSTI CSCL 20/8

The document is a supplement to AD-647 470 and describes the changes in the UNC-SAM-2 programs which have been made to accommodate a revised cross section format. The modified program has been designated UNC-SAM-3. Author (TAB)

N70-26787# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
ANGULAR DISTRIBUTION OF THE NEUTRON POLARIZATION FROM B 11 (ALPHA,N) N14 REACTION, AT LOW ENERGY
A. Ciocanel, M. Moles, C. Pencea, and O. Salageon 1969 6 p refs
(IFA-CRD-40) Avail: AEC Depository Libraries

The measurement of the neutron polarization from the B-11(alpha,neutron) N-14 reaction, at alpha particle energies of 3.6 and 3.8 MeV, was done to investigate the reaction mechanism and the level structure of the compound nucleus N-15. A time-of-flight standard technique with improved radiation shielding and proper resolution was used. The preliminary analysis of the experimental data indicates the formation of the compound-nucleus N-15 with the participation of the 13.63(5/2,7/2)(-), 13.70(?) and 13.79 (5/2)(+) excited levels in N-15. Subsequent calculation will make clear if the magnitude of the polarization is determined by the interference of these levels only, or if it will be necessary to take into account a ground term of the R-matrix, as well as a direct contribution, which is slowly changing with incident energy.

Author (NSA)

N70-26795# United Nuclear Corp., Elmsford, N.Y. Research and Engineering Center.

ENDT: A FORTRAN PROGRAM TO PREPARE CROSS-SECTION DATA FOR UNC-SAM-3 FROM ENDF/B TAPES Final Report

S. Kellman Jan. 1970 51 p refs

(Contract DASA01-69-C-0021)

(AD-701757; UNC-5243; DASA-2337) Avail: CFSTI CSCL 20/8

With the establishment of the Cross Section Evaluation Center at Brookhaven National Laboratory, more detailed, evaluated cross section information has become available, permitting more accurate analysis of problems of interest. In order to make use of this wealth of information in the UNC-SAM-3 Monte Carlo code, the ENDT program, generating an element data tape for later use in UNC-SAM-3 has been written. The present version of the code addresses itself to its use in generating the data required for shielding calculations and takes into consideration the accuracy of todays measurements. ENDT reads the Evaluated Nuclear Data File and calculates total, total scattering, and inelastic cross sections, and established the tables required to treat the angular distribution of neutrons emerging from elastic scattering collisions and the energy distribution of those emerging from inelastic scattering collisions. The code permits Doppler broadening in the resolved resonance range but in the present version no attempt has been made to extend the treatment to all energies since the effect has little significance in shielding calculations. The report tries to document the treatment of the cross section and distribution data, stating explicitly the assumptions made. The FORTRAN listing of the code contains numerous comment cards which should be helpful to a programmer going through the code, and should facilitate the alteration of the code to suit the needs of a given installation.

Author (TAB)

N70-26826# Scientific Translation Service, Ann Arbor, Mich.

INTRANUCLEAR CASCADES WITH ALLOWANCE FOR ALPHA-CLUSTERS

V. S. Barashenkov et al [1969] 9 p refs Transl. into ENGLISH from Rept. JINR-P2-4568 Sponsored by AEC Prepared for ORNL (ORNL-tr-2243; JINR-P2-4568) Avail: CFSTI

Intranuclear cascades in light nuclei are studied within the framework of the cluster model. Monte Carlo calculations were made on the intranuclear cascades following the interaction of 660-MeV protons with C-12. The C-12 nucleus was assumed to be a uniform spatial distribution of alpha-clusters with a sharp nuclear boundary. The results are compared with available experimental data.

NSA

N70-26853*# Southern Methodist Univ., Dallas, Tex. Dept. of Physics.

PENETRATION AND INTERACTION OF PROTONS WITH MATTER. PART 2: EXPERIMENTAL STUDIES USING SEMICONDUCTOR DETECTORS

George W. Crawford, ed. Oct. 1969 118 p refs

(Grant NGR-44-007-007)

(NASA-CR-108385; RR-69-1) Avail: CFSTI CSCL 20H

CONTENTS:

1. A NEW APPROACH TO THE ANALYSIS OF MEASUREMENTS OF PROTON STOPPING POWER M. Leimdorfer, C. Johansson, and G. W. Crawford 14 p refs (See N70-26854 13-24)

2. EVALUATION OF THE MOST PROBABLE ENERGY LOSS SUFFERED BY PROTONS PERPENDICULARLY INCIDENT ON PLANE PARALLEL ABSORBERS M. Leimdorfer and G. W. Crawford 10 p refs (See N70-26855 13-24)

3. CALIBRATION OF PULSEHEIGHT DISTRIBUTION IN TERMS OF PROTON ENERGY A. Bergstrom, M. Leimdorfer, E. K. Helwig, and G. W. Crawford 18 p (See N70-26856 13-24)

4. PROTON STOPPING POWER MEASUREMENTS IN SEVEN ELEMENTS G. W. Crawford, S. M. Curry, D. R. Dixon, P. H. Hunt, P. L. Kehler et al 8 p refs (See N70-26857 13-24)

5. STOPPING POWER MEASUREMENTS USING A MAGNETIC SPECTROMETER D. R. Dixon, S. M. Curry, B. Jung, and G. W. Crawford 12 p refs (See N70-26858 13-24)

6. MEAN IONIZATION POTENTIAL FOR MONTE CARLO PENETRATION OF CHARGED PARTICLES IN MATTER G. W. Crawford 31 p refs (See N70-26859 13-24)

7. MEAN IONIZATION POTENTIAL VALUES FOR MIXTURES AND COMPOUNDS G. W. Crawford 8 p ref (See N70-26860 13-24)

8. TABLES OF STOPPING POWERS FOR ELEMENTS, MIXTURES, AND COMPOUNDS G. W. Crawford 15 p (See N70-26861 13-24)

N70-26854*# Southern Methodist Univ., Dallas, Tex. Dept. of Physics.

A NEW APPROACH TO THE ANALYSIS OF MEASUREMENTS OF PROTON STOPPING POWER

Martin Leimdorfer, Claes Johansson, and George W. Crawford *In its* Penetration and Interaction of Protons with Matter, Part 2 Oct. 1969 14 p refs (See N70-26853 13-24)

Avail: CFSTI CSCL 20H

A computational procedure for extracting theoretically relevant information from measurements of the energy lost by protons in passing through a chosen material was developed. The measured quantities include the initial energy of the proton and the energy lost by the proton in passing through an absorber. The energies are recorded as multichannel pulse height distributions of charge as created in and collected from the active region of lithium-drifted silicon detectors. The detectors used were in each case long enough to totally absorb the entering proton. In order that these pulse height distributions be closely related to proton energy distributions, the detector was aligned in the proton beam so that the protons traveled parallel to the length of the detector. By keeping the parallel beam small in size as compared to the cross-section of the active region, and by centering the entrance point, the proton entering the detector had a high probability of being totally absorbed in the active region.

Author

N70-26855*# Southern Methodist Univ., Dallas, Tex. Dept. of Physics.

EVALUATION OF THE MOST PROBABLE ENERGY LOSS SUFFERED BY PROTONS PERPENDICULARLY INCIDENT ON PLANE PARALLEL ABSORBERS

Martin Leimdorfer and George W. Crawford *In its* Penetration and Interaction of Protons with Matter, Part 2 Oct. 1969 10 p refs (See N70-26853 13-24)

Avail: CFSTI CSCL 20H

The purpose is to show that the value of the most probable energy loss in the experimental case is useable as the mean energy

loss calculated from Monte Carlo proton transport code PROTOS 3. The average energy loss that should be the ultimate quantity to be derived from an experiment is understood to be that average energy which a charged particle loses when traveling a given path length. Since particles, penetrating through a plane parallel absorber foil have undergone coulomb interactions with the atoms of the absorber material, the actual path length is not a unique quantity in the experimental configuration for there is a distribution of path lengths, with an average value slightly larger than the foil thickness. Author

N70-26856*# Southern Methodist Univ., Dallas, Tex. Dept. of Physics.

CALIBRATION OF PULSEHEIGHT DISTRIBUTION IN TERMS OF PROTON ENERGY

Arne Bergstrom, Martin Leimdorfer, Elton K. Helwig, and George W. Crawford *In its* Penetration and Interaction of Protons with Matter, Part 2 Oct. 1969 18 p (See N70-26853 13-24)

Avail: CFSTI CSCL 20H

Problems of establishing the conversion formula form pulseheight (voltage) to proton energy and of assessing the accelerator beam energy and its effective dispersion are discussed. The stopping power as a function of energy for aluminum is assumed to be known. This means that the calibration will be performed relative to an aluminum standard. The basic data are a set of pulseheight distributions from measurements with different aluminum absorbers of varying thickness and the pulseheight distribution taken with no absorber in the beam. Author

N70-26857*# Southern Methodist Univ., Dallas, Tex. Dept. of Physics.

PROTON STOPPING POWER MEASUREMENTS IN SEVEN ELEMENTS

George W. Crawford, Stephen M. Curry, Danny R. Dixon, Patrick H. Hunt, Phillip L. Kehler et al *In its* Penetration and Interaction of Protons with Matter, Part 2 Oct. 1969 8 p refs (See N70-26853 13-24)

Avail: CFSTI CSCL 20H

The purpose is to contribute a reliable set of measurements from which the mean ionization potential of each of seven elements (beryllium, carbon, aluminum, silicon, iron, copper, and lead) can be calculated. The energy lost by a proton passing through an absorber was measured. The measured quantities included the initial energy of the proton, the most probable energy of the unscattered proton after leaving the absorber, and the shortest possible distance through the absorber. The energies were recorded as multichannel pulse height distributions of charge created in and collected from the active region of lithium-drifted silicon detectors. The detectors used were in each case large enough to totally absorb the entering proton beam. In order to obtain a single data point, four separate measurements were made using two detectors of different volumes and two nearly identical absorbers. Author

N70-26858*# Southern Methodist Univ., Dallas, Tex. Dept. of Physics.

STOPPING POWER MEASUREMENTS USING A MAGNETIC SPECTROMETER

Danny R. Dixon, Stephen M. Curry, Bo Jung, and George W. Crawford *In its* Penetration and Interaction of Protons with Matter, Part 2 Oct. 1969 12 p refs (See N70-26853 13-24)

Avail: CFSTI CSCL 20H

The 185 MeV protons from a synchrocyclotron have been used in a study of the energy lost by protons in traversing various metals and plastics. Data were taken using a double two-fold coincidence telescope system with six energy channels. Each line of data was analyzed using a CDC 3600 computer. Author

N70-26859*# Southern Methodist Univ., Dallas, Tex. Dept. of Physics.

MEAN IONIZATION POTENTIAL FOR MONTE CARLO PENETRATION OF CHARGED PARTICLES IN MATTER

George W. Crawford *In its* Penetration and Interaction of Protons with Matter, Part 2 Oct. 1969 31 p refs (See N70-26853 13-24)

Avail: CFSTI CSCL 20H

Tables of energy losses and ranges are given based on adjusted values of the mean ionization potential determined from earlier stopping power of range measurements and assuming a straight-ahead model. This model assumes that the incident particles lose energy by ionization losses with the removal of atomic electrons in the target material with no subsequent change in the incident particle direction. The latest form of the straight-ahead stopping power equation is used as part of a Monte Carlo nucleon transport program, PROTOS 3. The incident particle is permitted to interact with the free and bound atomic electrons, to undergo small angle scattering from the electrons, to have large angle scattering from the nucleus and to create nuclear reactions. As nearly as possible, the program attempts to duplicate the actual path of any incident particle. The straight-ahead model assumption that the path of the particle is the shortest distance from entrance to exit in a medium can be corrected in a number of ways. PROTOS 3 corrects for this by permitting multiple scattering. It further treats each particle penetration as an individual history, different from all others. A Monte Carlo histogram is compiled giving the distribution of emerging particles with respect to location, angle of emergence, and energy of the particle as it emerges. Author

N70-26860*# Southern Methodist Univ., Dallas, Tex. Dept. of Physics.

MEAN IONIZATION POTENTIAL VALUES FOR MIXTURES AND COMPOUNDS

George W. Crawford *In its* Penetration and Interaction of Protons with Matter, Part 2 Oct. 1969 8 p ref (See N70-26853 13-24)

Avail: CFSTI CSCL 20H

As part of stopping power measurements, data were taken using lucite, nylon, polyethylene, and tissue equivalent plastics. The plastics were inserted in the beam in sequence with the elements and data were taken and processed for them in exactly the same way as for the elements. In order to obtain a single data point, four separate measurements were made using two detectors of different volumes and two nearly identical absorbers. Author

N70-26861*# Southern Methodist Univ., Dallas, Tex. Dept. of Physics.

TABLES OF STOPPING POWERS FOR ELEMENTS, MIXTURES, AND COMPOUNDS

George W. Crawford *In its* Penetration and Interaction of Protons with Matter, Part 2 Oct. 1969 15 p (See N70-26853 13-24)

Avail: CFSTI CSCL 20H

Tables show proton stopping powar values for elements Z=1.5-86 and for four plastics (lucite, nylon, polyethelene, and TE(C27H21ON). E.C.

N70-26875# Stanford Linear Accelerator Center, Calif.

HIGH-ENERGY INTERACTIONS OF GAMMA QUANTA AND ELECTRONS WITH NUCLEI [VZAIMODEISTVIE GAMMA-KVANTOV I ELEKTRONOV S YADRAMI PRI VYSOKIKH ENERGIYAKH]

V. N. Gribov [1969] 40 p Transl. into ENGLISH from the Proceedings of the Conf. on the 4th Winter Seminar on the Theory of the Nucleus and the Phys. of High Energies (Leningrad), 5-17 Feb. 1969 40 p

(SLAC-Trans-102; CONF-690217-1) Avail: CFSTI

It is shown that the character of the interaction of photons and neutrinos with nuclei and the development of surface effects at high energies have no relation with meson rho or meson pi dominance but are determined solely by which distances are significant in those interactions. It is shown that if the longitudinal distances are of the order delta = P/mu squared then the total cross section of gamma quanta with heavy nuclei can be expressed in terms of the hadron part of the Lehmann density of the photon Green function of the electron pair annihilation of hadron cross section. NSA

N70-26877# Battelle-Northwest, Richland, Wash. Reactor Physics Dept.
EGGNIT: A MULTIGROUP CROSS SECTION CODE
C. R. Richey Nov. 1969 65 p refs
(Contract AT(45-1)-1830)
(BNWL-1203) Avail: CFSTI

The EGGNIT code has been developed to generate multigroup constants for neutron diffusion and transport calculations. This code is a major revision of the GAMTEC-II code. Most of the revisions were made in the resonance theory treatment where the added Nordheim numerical integration method permits treating absorbers and admixed scatterers exactly. An iteration technique is utilized to extend Nordheim's method to multiregion and other complex geometries. Other added features in EGGNIT are: interference absorption due to a nearby resonance line is permitted, interference scattering is included, resonance absorption integral contributes to the absorption of several GAM-I fine groups, and Dancoff shielding correction is computed for either square or hexagonal lattices by Carlvik's DASQUE program. Author (NSA)

N70-26907# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
THE FINE STRUCTURE OF THE C 12 (GAMMA, NEUTRON) C 11 CROSS SECTION
G. Baciu, D. Catana, C. Deberth, C. Iliescu, and B. Cirstoiu 1969 14 p refs
(IFA-M-42) Avail: AEC Depository Libraries

The cross section for the C-12(gamma,n)C-11 reaction was measured from threshold to 25 MeV with a small energy bin (100 keV). The giant resonance was resolved into a very well defined triplet structure. It seems that the shape of the C-12(gamma,n)C-11 cross section is influenced by the dipole-quadrupole coupling. Author (NSA)

N70-26930# Muenster Univ., (West Germany). Inst. fuer Theoretische Physik.
QUANTIZED FIELDS AS OPERATOR-VALUED DISTRIBUTIONS [QUANTISIERTE FELDER ALS OPERATORWERTIGE DISTRIBUTIONEN]
C. V. Westenholz Oct. 1969 10 p refs In GERMAN
(BMwF-FBK-69-30) Avail: AEC Depository Libraries

A class of operator-valued fields are defined over a function-space of the test functions, and these fields are considered as representatives of all free quantum fields. Then some postulates of the axiomatic quantum field theory are proved, such as the existence of a continuous expectation functional. Author (NSA)

N70-26931# Strathclyde Univ., Glasgow (Scotland). Dept. of Mechanical Engineering.
MULTIGROUP NEUTRON TRANSPORT EQUATION IN THE DIFFUSION AND P 1 APPROXIMATION
D. Obradovic [1969] 31 p refs Prepared jointly with Scottish Res. Reactor Centre
(SRRC-35/69) Avail: AEC Depository Libraries

Investigations of the properties of the multigroup transport operator, with and without delayed neutrons in the diffusion and P sub 1 approximation, is performed using Keldis's theory of operator families as well as a technique recently used for investigations into the properties of the general linearized Boltzmann operator. It is shown that in the case without delayed neutrons, the multigroup transport operator in the diffusion and P sub 1 approximation possesses a complete set of generalized eigenvectors A formal solution to the initial value problem is also given. Author (NSA)

N70-26956# IIT Research Inst., Chicago, Ill. Physics Dept.
TWO NUCLEON INTERACTIONS OF K(−) MESONS IN DEUTERIUM Technical Report
V. R. Veirs and R. A. Burnstein Feb. 1970 14 p refs
(TR-109) Avail: CFSTI

Direct measurements of all two nucleon interactions of stopping negative Kaons in deuterium have been made in a bubble chamber experiment. The production rates relative to the single nucleon interactions of negative Kaons are given. The ratio of the rates is consistent with the prediction of isotopic spin invariance for the strong interactions. The total two nucleon production rate is 1.22 + or − 0.09% and is compared with current theoretical predictions. Author

N70-26972# Bundesministerium fuer Wissenschaftliche Forschung, Bad Godesberg (West Germany).
THE APPLICATION OF SIMPLE THERMALIZATION MODELS TO NEUTRON SPECTRA CALCULATIONS IN INFINITE HOMOGENEOUS MEDIA WITH ARBITRARY ABSORPTION [DIE ANWENDUNG EINFACHER THERMALISIERUNGSMODELLE ZUR BERECHNUNG VON NEUTRONENSPEKTREN IN HOMOGENEN, UNENDLICH AUSGEDEHNTEN MEDIEN FUER BELIEBIGE ABSORPTION]
K. Essig May 1969 58 p refs In GERMAN
(BMwF-FBK-69-17) Avail: AEC Depository Libraries

Calculations of neutron distributions in infinite homogeneous media were carried out assuming a 1/v absorption law. The secondary model reduces this problem to the solution of a second-order linear differential equation in the energy variable E. This simple thermalization model involves two functions characterizing the specific moderator structures. Suitable combinations of these functions were approximated by polynomials in E superscript 1/2. A generalization of a method developed by Kunze permits the solution of the differential equation. This solution, being subject to some boundary conditions, shows an analytic behavior. Neutron spectra calculated with 6 to 8 parameters reproduce experimental data with good accuracy. Author (NSA)

N70-27027*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A MICROSCOPIC TEST OF INVERTED NUCLEAR COEXISTENCE
Richard C. Braley and William F. Ford Apr. 1970 10 p refs Presented at Am. Phys. Soc. Meeting, Washington, D.C., 27-30 Apr. 1970
(NASA-TM-X-52798) Avail: CFSTI CSCL 20H

The Hartree-Fock method of deformed orbitals is less successful for nuclei in the upper half of the 2s-1d shell than for those in the lower half. Of the nuclei in the upper half, Si-28 and S-32 have received perhaps the greatest attention. Certain features of their spectra motivated others to investigate the possibility of inverted coexistence in these nuclei. In this study, the ground state intrinsic wavefunctions for Si-28 and S-32 are each assumed to be a spherical plus deformed Slater determinant. States of good angular momentum are obtained by projection. Several nuclear properties such as radii, transition rates, electron scattering, form factors, and nucleon scattering cross sections are calculated and compared with experiment. Author

N70-27033# Western Kentucky Univ., Bowling Green.
AN INVESTIGATION OF THE REFLECTION OF SLOW ELECTRONS FROM SURFACES Final Report, 1 Jun. 1966–30 Nov. 1969
Marvin W. Russell 30 Dec. 1969 61 p refs
(Contract AF 19(628)-5940)
(AD-701405; AFCRL-70-0002) Avail: CFSTI CSCL 7/4

Reflection coefficient vs. electron energy measurements have been made for polycrystalline tungsten and tungsten coated stainless steel. A crossed-field trochoidal trajectory method was developed to achieve reliable operation below 1 eV and to accomplish greater versatility in measurement technique. The measurements have been extended from 10 eV down to 0.2 eV. Reflection coefficients increased almost linearly with energy in the 0.2 - 1 eV range. The effects of changes in surface conditions on reflections have been investigated. Values of R ranging from 0.08 to 0.7 were detected. The feasibility of utilizing the trochoidal trajectory method to study ion reflection phenomena is discussed. Author (TAB)

N70-27055# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
QED TEST BY POSITRON-ELECTRON SCATTERING AT 2 x 510 MeV
J. E. Augustin, J. Buon, B. Delcourt, J. Jeanjean, H. Nguyen Ngoc et al Sep. 1969 19 p refs
(LAL-1221) Avail: AEC Depository Libraries

Elastic electron–positron scattering was studied at a cms energy of 2 x 510 MeV. Large-angle scattering events were registered using scintillation counters and spark chambers. The results for the cross sections provide a test of quantum electrodynamics. NSA

N70-27107*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MIRCOSCOPIC COUPLED CHANNEL STUDY OF INELASTIC PROTON SCATTERING FROM Ne 20
R. J. Ascuitto (Yale Univ.), W. F. Ford, R. C. Braley, and J. Bar-Touv (Ohio State Univ.) Apr. 1970 10 p refs Presented at the Am. Phys. Soc. Meeting, Washington, D.C., 27-30 Apr. 1970
(NASA-TM-X-52797) Avail: CFSTI CSCL 20H

An attempt was made to explain proton inelastic scattering from Ne-20 using projected Hartree-Fock wave functions. A coupled channel calculation was carried out with the explicit inclusion of at least the O(+), 2(+), and 4(+) members of the ground state rotational band. A comparison is made with experiment and with DW8A predictions for the same reaction. Also studied is the effect on the cross sections of truncating the basis space used for the Hartree-Fock states. Author

N70-27154# Brandeis Univ., Waltham, Mass. Dept. of Physics.
INTERNAL FIELD OF Sc IN A Ni HOST
C. Hohenemser, R. Reno, and H. C. Benski 31 Oct. 1969 31 p refs Presented at Ann. Meeting of the Am. Phys. Soc., England
(Contract AT(30-1)-3823)
(NYO-3023-5; Conf-700102-1; TR-1) Avail: CFSTI

Using the technique of time differential perturbed angular correlations the sign and magnitude of the internal field of Sc-44 nuclei in a Ni host from 90 K to the Curie point was observed. The result obtained at 90 K is the internal field equals –21.9 + or – 1.0 kG. This is consistent with the conduction electron polarization (CEP) model. The observed temperature variation of the internal field is somewhat problematical. Although the shape of the internal field (T) is roughly as expected, the Curie point is shifted downward by 98 K. This could be due to impurities introduced unwittingly into the diffused Ti-44 source. The data also suggest that there are probably two or more magnetic sites, which at low temperature have the same sign for the internal field, and are separated by no more than 1 or 2 kG. Further work is in progress. Author

N70-27155# Brandeis Univ., Waltham, Mass. Dept. of Physics.
INTERNAL FIELD OF Rh IN A Ni HOST NEAR THE CURIE POINT
C. Hohenemser and R. Reno 31 Oct. 1969 14 p refs Presented at Ann. Meeting of the Am. Phys. Soc., Chicago
(Contract AT(30-1)-3823)
(NYO-3823-6; Conf-700102-2; TR-2) Avail: CFSTI

Using the technique of time differential perturbed angular correlations, the internal field of Rh-100 in a Ni host for temperatures in the critical region (365-371 C) was observed. Polarizing fields between 20 and 620 G were used for a source foil clamped to the poles of an electromagnet. Using NaI(Tl) counters and optimal resolution, internal field values up to 20 kG were detected. Given the halflife of the intermediate state, internal field values as low as 100 G should be detectable. Since at room temperture the internal field = 200 kG, Rh is one of the most sensitive probes known for critical studies. In addition it is found: (1) there is suggestive evidence for multiple magnetic sites. (2) the Curie point observed in different sources varies as much as 1-2 C. Further work is in progress. Author

N70-27164*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
A PROPOSAL CONCERNING TERMINOLOGY IN REDUCED DENSITY MATRIX THEORY
Vedene H. Smith, Jr. (Queens Univ.–Kingston, Ontario) and John E. Harriman 23 Feb. 1970 11 p refs Sponsored in part by the Natl. Res. Council of Can. and the Ontario Dept. of Univ. Affairs
(Grants NGL-50-002-001; NSF GP-12832)
(NASA-CR-109841; WIS-TCI-379) Avail: CFSTI CSCL 20H

Among the criteria proposed for a desirable terminology are the following: (1) The names given to eigenfunctions of a particular density matrix compunent should be descriptive, identifying in a clear and reasonable way the component involved. (2) The set of different names should be systematically related, with as much similarity between different names as is consistent with (1). (3) Names chosen should be as brief as possible, consistent with (1) and (2). (4) When possible in terms of the other criteria, established names should be altered as little as possible. Author

N70-27187# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
RADIOCHEMICAL ANALYSIS SECTION: SUMMARY OF ACTIVITIES, JULY 1968 TO JUNE 1969
James R. De Voe, ed. Feb. 1970 149 p refs
(NBS-TN-501) Avail: SOD $1.25 Catalog No. C13.46:501

CONTENTS:

1. MOESSBAUER SPECTROSCOPY p 2–51 (See N70-27188 13-14)
2. NUCLEAR CHEMISTRY p 52–88 (See N70-27189 13-06)
3. NUCLEAR INSTRUMENTATION p 89–105 (See N70-27190 13-14)
4. RADIOISOTOPE TECHNIQUES p 106–114 (See N70-27191 13-24)

N70-27191# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
RADIOISOTOPE TECHNIQUES
In its Radiochem. Analysis Sect. Feb. 1970 p 106–114 (See N70-27187 13-24)
Avail: SOD $1.25 Catalog No. C13.46:501

Substoichiometric radioisotope dilution analysis techniques are described for determining specific activities before and after dilution by the analyzed element. The counting system used for determining the radioactivity of the standard solution and the activity of the unknown solution is discussed and the precautions taken to yield the minimum error obtainable are given. R.B.

N70-27198# Rome Univ. (Italy). Inst. of Physics.
A GROUP THEORETICAL ANALYSIS OF BETA DECAYS OF SOMEJ = 3/2 LIGHT NUCLEI
M. Scalia (Ph.D. Thesis) 27 Sep. 1969 16 p refs Submitted for publication *Its* Nota Interna No. 241
Avail: CFSTI

The aim of this work is to test the generalized pairing Hamiltonian forces model and to this end beta transitions of J = 3/2 light nuclei between nuclear states classified through irreducible representations of Sp(4) are analyzed in the j-j scheme. ESRO

N70-27201# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
VALIDITY OF RADIOACTIVE STANDARDS [VALIDITE DES ETALONS RADIOACTIFS]
Yves Le Gallic and Marie Thenard Mar. 1970 55 p refs In FRENCH; ENGLISH summary
(CEA-R-3975) Avail: CFSTI

Primary radioactive standards are improtant for the reliability of the work of national laboratories. Secondary standards are more commonly used but it is necessary to have confidence in them. The manufacture of such standards and the different sources of the errors are discussed. The international comparisons in which the Laboratoire de Metorologie de la Radioactivite participates are reviewed and shown to be important but they reveal the necessity of primary standards. Author (ESRO)

N70-27203# Syracuse Univ., N.Y. Dept. of Physics.
WHY ETA AND ETA PRIME MIGHT HAVE THE SAME MIXING AS PHI AND OMEGA
William Case Oct. 1969 12 p refs Sponsored by AEC
(SU-1206-213; NYO-3399-213) Avail: CFSTI

Eta and eta prime are assumed to have the same mixing as is usually attributed to phi and omega and the resulting implications are drawn using generally accepted methods. Such a mixing is shown to satisfy a linear Gell-Mann Okubo mass formula to about 5%. It is also shown to correctly predict the branching ratios, while the generally accepted mixing (cos alpha = .98 sin alpha = + or − .18) fails. Lastly, this mixing is used with a vector dominance model to obtain a value for the total width of eta which is close to the accepted experimental value. Author (NSA)

N70-27244# Paris Univ., Orsay (France). Laboratoire de l'Accelerateur.
EXPERIMENTS WITH ORSAY STORAGE RING ACO
J. Perez-Y-Jorba Sep. 1969 37 p refs Presented at the Intern. Symp. on Electron and Photon Interactions at High Energies, Daresbury, 14-20 Sep. 1969
(LAL-1222) Avail: CFSTI

Various experiments using the Orsay storage ring are described. These experiments are the phi meson decay into positive kaon and negative kaon, phi meson decay into two neutral kaons, and phi meson decay into 3 pion, 2 pion production, and omega meson-rho meson interference. Also quantum electrodynamics experiments are discussed including double bremsstrahlung luminosity measurement, QED test in Bhabha scattering, and the positive muon negative muon test of QED. Beam polarization, coupling constants and sum rules, and finite width effects and vacuum polarization are also discussed. NSA

N70-27245# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Physics.
THEORETICAL ANALYSIS OF CONSECUTIVE ION-MOLECULE REACTIONS. 1: THE MECHANISMS IN A TANDEM MASS SPECTROMETER OF PERPENDICULAR TYPE Scientific Report
Imre Szabo Apr. 1969 61 p refs
(Contract F61052-68-C-0067)
(AD-699242; AFCRL-69-0319) Avail: CFSTI CSCL 7/4

An elementary theory has been developed for consecutive ion-molecule reaction mechanism in the gas phase at low kinetic energies of the ions. The nature of the individual ion-molecule collisions is studied, and in this way a number of possible reaction sequences are distinguished and analyzed. The theory is applied to tandem mass spectrometers of perpendicular type and the intensities, I(n), of the ions of different order, n, are calculated. Three possible methods are suggested for identifying the kinetic order of the ions, as well as methods for determining the microscopic reaction rate constants and cross sections. These data can be determined at different excitation energies of the parent molecule ions that initiate the consecutive ion-molecule reactions. Author (TAB)

N70-27251# Syracuse Univ., N.Y. Dept. of Physics.
INELASTIC E-P SCATTERING DATA AND A NEW PARTON MODEL
C. W. Gardiner and D. P. Majumdar Dec. 1969 10 p refs Sponsored by AEC
(SU-1206-207; NYO-3399-207) Avail: CFSTI

A parton model with integrally charged partons and a minimum number of partons equal to four is proposed as an alternative to the quark-parton models. It is found to give an excellent fit to the experimental data presently available, showing the validity of the parton concepts. Author (NSA)

N70-27269# Chalmers Univ. of Technology, Goteborg (Sweden).
DETERMINATION OF NEUTRON DECAY CONSTANTS USING SIMULTANEOUS PULSE HEIGHT AND TIME ANALYSIS
Gudmar Grosshoeg Dec. 1968 51 p refs
(CTH-RF-16) Avail: CFSTI

A series of experiments was made to solve the problem of higher modes and background in determination of fundamental decay constants with pulsed neutrons. A 150 keV SAMES neutron source was used together with a rotating cylindrical moderator composed of up to 8 polyethylene discs of 2.2 cm thickness and a dia of 18 cm. The moderator was placed in an Al box and shielded with B sub 4 C. Three detectors were placed outside the moderator: the first and third one at positions where the second mode of the cylindrical function was zero and the second moderator at the maximum point of the fundamental mode. NSA

N70-27278# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France).
NUCLEAR SPECTROMETRY BETWEEN 0 AND 100 KeV WITH A PROPORTIONAL COUNTER: APPLICATION TO Pu241 Bk249. CONVERSION ELECTRONS OF HEAVY ELEMENTS. [SPECTROMETRE NUCLEAIRE ENTRE 0 ET 100 KeV PAR COMPTEUR PROPORTIONNEL: APPLICATION A L'ETUDE DE Pu241 Bk 249. ELECTRONS DE CONVERSION DES ELEMENTS LOURDS]
Jeanine Grenier, Rene Le Du, and Bernard Miltenberger Feb. 1970 23 p In FRENCH; ENGLISH summary
(CEA-R-3938) Avail: CFSTI

A 2 pion proportional counter, suitable for the spectrometry of soft beta and X radiations (E less than or equal to 100 keV).

is described. A new field ring arrangement was used to reduce the background in the energy band 0 to 100 keV. The beta spectra of Pu-241 (E sub max approximately 20 keV) and Bk-249 (E sub max approximately 100 keV) were studied and the Curie plots obtained are in good agreement with the results from magnetic spectrometers. The internal conversion electrons of the soft gamma radiations of Pu-237 were also investigated. Author (ESRO)

N70-27415# Rome Univ. (Italy). Inst. of Physics.
SOLUTION OF A THREE-BODY SCATTERING PROBLEM IN ONE DIMENSION
C. Marchioro 15 Oct. 1968 15 p refs *Its* Nota Interna 243
Avail: CFSTI

The scattering problem of three equal particles interacting via repulsive inverse-cube forces is solved in one dimension both in the classical and the quantal cases. The quantal S-matrix is similar to that produced by repulsive delta-function interaction of infinite strength. Author (ESRO)

N70-27470# Chicago Univ., Ill. Enrico Fermi Inst.
EXPERIMENTAL STUDY OF WEAK INTERACTIONS Technical Progress Report
Roland Winston Jan. 1970 7 p refs
(Contract AT(11-1)-1701)
(COO-1701-9) Avail: CFSTI

A preliminary outline of research completed on lambda beta decays as a test of Cabibbo theory and time reversal invariance is presented. NSA

N70-27503# Karlsruhe Univ. (West Germany). Inst. fuer Struktur der Materie.
CALCULATION OF CRITICAL QUANTITIES FOR NEUTRON TRANSPORT THEORY IN PLANE GEOMETRY, PART 1
H. Winkler Jun. 1969 73 p refs In GERMAN
(BMwF-FBK-69-24) Avail: AEC Depository Libraries

A solution by W. Kobink in P sub L-approximation for the stationary monoenergetic Boltzmann equation in plane geometry and for linear anisotropic scattering using the spherical harmonics method is described. This solves the critical problem for a homogeneous slab of finite thickness. In the limit L goes to infinity an exact solution which is very suitable for numerical calculations is derived. This procedure represents an enlargement of the critical problem of a slab to linear anisotropic scattering. Author (NSA)

N70-27510# Reactor Centrum Nederland, Petten.
ANDANTE: AN ALGOL PROGRAM FOR DECOMPOSITION OF GAMMA-RAY SPECTRA AND PROCESSING OF FOIL COUNTING DATA
H. P. Struch Dec. 1969 131 p ref
(RCN-116) Avail: CFSTI

ANDANTE is a program for the analysis of foil cointing data obtained in neutron activation. The gamma-ray spectra are supposed to be measured with aid of NaI(Tl) scintillation crystals and counted with multichannel analyzers. The program provides relative counting rates, activity, flux, and fluence values. In addition, ANDANTE is rather well suited to decompose a complex spectrum into its known constituent spectra. Provisions are included to reject constituents, which during the calculation, appear to be non-significant. The program can be run in 63 various modes; this allows the user to apply ANDANTE in many different ways. Author (ESRO)

N70-27513*# Ling-Temco-Vought, Inc., Dallas, Tex. Nuclear and Space Physics Group.
COMPARISONS OF EXPERIMENTAL AND CALCULATED ELECTRON TRANSMISSION AND BREMSSTRAHLUNG SPECTRA FOR ELECTRON ENERGIES BELOW 3.0 MeV Final Report, 12 Mar. 1969 – 12 Mar. 1970
D. H. Rester Mar. 1970 64 p refs
(Contract NAS8-30521)
(NASA-CR-102662; Rept-0-71100/0R-6) Avail: CFSTI CSCL 20H

Numerous comparisons of the experimental results published earlier are made to the thick-target bremsstrahlung and electron diffusion spectra generated by the Monte Carlo program ETRAN 15. In addition to comparisons of thick-target bremsstrahlung and electron transmission spectra, several comparisons of experimental electron bremsstrahlung cross-section values to theoretical values from a relativistic, self-consistent field model are included. Because of the complexity of the theory, it was practical to evaluate the formulas only in a restricted electron energy range. Author

N70-27517# Pittsburgh Univ., Pa. Dept. of Physics.
THE NONCOMPACT GROUP SU(2,2) AND ELECTROMAGNETIC FOAM FACTORS OF BARYONS
Tsu Yao Oct. 1969 44 p refs
(Contract AT(30-1)-3829)
(NYO-3829-40) Avail: CFSTI

The noncompact group SU(2,2) and its unitary irreducible representations are used in the calculation of the electromagnetic form factors of baryons. The electromagnetic current is assumed to transform like the generators of the group. The principal series and the most degenerate discrete series are of particular interest since their ground states are precisely the same as those of the four-dimensional Dirac representation. This unitary analog of the Dirac representation suggests reducible representations which are integral sums over rho of UIR's in the principal series. Requiring that a form factor should be expressible in a closed analytic form puts severe restrictions on the weight function A(rho). A one-parameter formula which asymptotically behaves like t to the minus 5/2 power and gives a satisfactory fit to the available experimental data to within 10 – 15% is found. Author (NSA)

N70-27520# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
NUCLEAR REACTIONS IN LIGHT NUCLEI AND MOESSBAUER STUDIES
Oct. 1969 144 p refs
(Contract AT(30-1)-2028)
(NYO-2028-4) Avail: CFSTI

Summaries of the research during this reporting period are presented. Included topics are: (1) determination of nuclear moments of several rare earth isotopes, (2) Mossbauer effect experiments, (3) determination of the moment of B12 using techniques of resonance destruction of nuclear polarization, and (4) development of polarization detector using GeLi detector. F.O.S.

N70-27522# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
A COMPUTER PROGRAM FOR THE SOLUTION OF THE ONE-DIMENSIONAL DIFFUSION EQUATION FOR NEUTRONS WITH SEVERAL ENERGY GROUPS IN THREE-ZONE ARRANGEMENTS OF VARIOUS MATERIALS (EINDIF) [EIN RECHENPROGRAM ZUR LOESUNG DER EINDIMENSIONALEN DIFFUSIONSGLEICHUNG FUER NEUTRONEN MIT MEHREREN ENERGIEGRUPPEN IN DREI-ZONENANORDNUNG AUS UNTERSCHIEDLICHEN STOFFEN (EINDIF)]
H.-H. Schweer May 1969 21 p refs In GERMAN; ENGLISH summary
(FMRB-28/29) Avail: AEC Depository Libraries

The multiplication factor for neutrons in a reactor configuration is computed approximately by a code based on diffusion

theory. The one-dimensional code is prepared for several energy groups and three material regions. The code, written in programming language ALGOL, may be applied to a single package containing fissile material and to an assembly of packages. Author

N70-27523# Oak Ridge National Lab., Tenn.
PULSE-SHAPE MEASUREMENTS FOR THE OAK RIDGE ELECTRON LINEAR ACCELERATOR WITH GAMMA-RAY DETECTION TECHNIQUES
L. W. Weston and J. H. Todd 20 Jan. 1970 13 p refs
(ORNL-TM-2833) Avail: CFSTI

A study of the pulse-shape characteristics of the Oak Ridge Electron Linear Accelerator was carried out because the resolution of neutron cross section and neutron spectra measurements are directly dependent upon this pulse shape. Gamma-ray detection with techniques commonly used in neutron time-of-flight experiments was used in the study because of the fidelity with which the pulse shape could be measured. Author (NSA)

N70-27538# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
MUG: A PROGRAM FOR GENERATING MULTIGROUP PHOTON CROSS SECTIONS
J. R. Knight and F. R. Mynatt 20 Jan. 1970 36 p refs
(Contract W-7405-eng-26)
(CTC-17) Avail: CFSTI

MUG is a FORTRAN 4 program which generates multigroup photon cross sections suitable for use in discrete ordinate transport codes. The theory for the calculations is discussed, and the methods of obtaining energy group averaged scattering and absorption cross sections are described. A description of the input and output for the program is included. A sample problem is shown in the appendix. The MUG program was originally programmed for the IBM 7090 computer and put into operation in mid 1966. Subsequent conversion to the 360 computers and updating of the various options in the code have delayed formal publication. Author (NSA)

N70-27539# Brookhaven National Lab., Upton, N.Y.
USE OF POLARIZED PROTON TARGET AS A NEUTRON POLARIZER
V. I. Lushchikov et al Sep. 1969 47 p refs Transl. into ENGLISH from the report JINR-P3-4409
(BNL-TR-295; JINR-P3-4409) Avail: CFSTI

Theoretical grounds of the method of neutron polarization by transmission through a polarized proton target are presented. In this way 65% polarization of neutrons in the resonance energy region (up to several tens of keV) was reached with the help of a target of lanthanum-magnesium nitrate (LMN) monocrystal reducing the intensity of the neutron beam by 5 times; the target area being 15 sq cm. The method is effective as well for the thermal and cold neutron polarization, giving a considerable gain in the aperture ratio as compared to the other known methods. Different cross sections which determine the effect of a neutron polarizer with the LMN crystal on 0.001-50 eV neutrons are presented. Author (NSA)

N70-27554# Los Alamos Scientific Lab., N.Mex.
NEUTRON INDUCED FISSION CROSS SECTIONS FOR U 235 FROM THE PERSIMMON EVENT
J. D. Cramer and D. W. Bergen Oct. 1969 24 p refs
(Contract W-7405-eng-36)
(LA-4285) Avail: CFSTI

The U-235(n,f) cross section was measured for incident neutron energies of from 20 to 1000 eV relative to the Li-6(n,alpha)T and He-3(n,p)T reaction cross sections. Neutron energies were separated by time of flight from the single burst of an underground nuclear detonation in an approximately 300-m evacuated flight path. Results of this experiment are compared with previous measurements of the U-235(n,f) cross section. Author (NSA)

N70-27555 Paris Univ. (France). Faculte des Sciences.
CONTRIBUTION TO THE STUDY OF ELECTROMAGNETIC RADIATION ATTENUATION IN MATTER [CONTRIBUTION A L'ETUDE DE L'ATTENUATION DU RAYONNEMENT ELECTROMAGNETIQUE DANS LA MATIERE]
Alfred Maquet (Ph.D. Thesis) 1969 103 p refs In FRENCH
Avail: Issuing Activity

The global attenuation coefficient of low energy (0.2 - 2.0 MeV) gamma radiation arises from the photoelectric effect, particle scattering and pair creation. The general problem of photon scattering by K electrons in this energy range was considered and K layer cross sections for the photoelectric effect were computed by interpolation of a table of the total cross section of each atom. The elastic and inelastic scattering of photons by K electrons as well as the matrix elements for Compton, Raman and Rayleigh scattering were computed using a non-relativistic analytic expansion of a Green function. The work now needs to be extended to the relativistic domain. ESRO

N70-27577# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
NUCLEAR PHYSICS LABORATORY Progress Report, 1 Nov. 1968 - 31 Oct. 1969
31 Oct. 1969 59 p refs
(Contract AT(11-1)-1573)
(COO-1573-63) Avail: CFSTI

An experimental research program is reported on elastic and inelastic neutron scattering, polarizations of neutrons from the C12(d,n) reaction, radiation detector efficiency, polarization of neutrons from the O16(d,n)F17 reaction, deexcitation mechanism involving neutron emission, the T(d,n gamma)He4 branching rate, deuteron reactions on Cl3, (He3,n) reaction cross sections and polarization, data reduction of pulse-height spectra, and computer programs. NSA

N70-27582# Paris Univ., Orsay (France). Laboratoire de l'Accelerateur.
EQUIVALENCE OF LOCAL AND NON-LOCAL POTENTIALS AND THE PEREY EFFECT
Taber de Forest, Jr. Oct. 1969 19 p refs
(LAL-1223) Avail: AEC Depository Libraries

A general discussion of the Perey effect (P) which relates the wave functions in equivalent nonlocal and energy-dependent local potentials is presented. In general this relation is nonlocal, however it is shown that P must contain a local part. For reasonable potentials the local part is expected to be the most important contribution to P. Typically this produces a 15 to 20% reduction in the wave function within the nucleus for nuclear scattering. This is also shown explicitly by generating by means of an expansion an equivalent nonlocal potential from a given local potential. If the nonlocal potential is assumed to have the realistic form this allows one to determine P and thus obtain realistic wave functions directly from those used in the usual optical model analysis of the scattering. Finally this expansion when applied in reverse provides an extension of the effective mass approximation. Author (NSA)

N70-27582# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
A STUDY OF THE PARAMETERS OF DOSIMETRY AND THEIR EXPRESSION AT ELEMENTARY INTERACTION LEVEL [ETUDE DES PARAMETRES DE LA DOSIMETRIE ET DE LEUR EXPRESSION AU NIVEAU DES INTERACTIONS ELEMENTAIRES]

Eliane Abillon, Pierre Delattre, Gilbert Naudet, and Robert Senaux
Mar. 1970 187 p refs In FRENCH; ENGLISH summary
(CEA-R-3964) Avail: CFSTI

This report shows how the parameters currently used in dosimetry can be expressed at an elementary interaction level. The main expressions and parameters of dosimetry in their most general meaning (from conventional dosimetry down to microdosimetry) are discussed. For all the branches involved the action of radiation on a medium is based on an energy release. Elementary interactions are those occurring between the actual radiation in the medium and its constituent elements e.g. atoms, ions, radicals and the action of radiation is converted into a series of elementary events such as ionization, excitation, electronic recombination, etc. Each of these events is defined as the product of a cross section and a flux and it is shown that the reference parameters needed to account for the evolution of a system exposed to radiation are the particle spectra and the interaction cross-sections.
Author (ESRO)

N70-27597# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

TWO-POINT FUNCTIONS FOR LOCAL INFINITE-COMPONENT FIELDS

A. I. Oksak and I. T. Todorov 1969 47 p refs In RUSSIAN; ENGLISH summary
(JINR-P2-4812) Avail: AEC Depository Libraries

A two-point function of local infinite-component fields phi and psi transforming under arbitrary irreducible representations chi sub 1 and chi sub 2 of the proper Lorentz group is studied by the manifestly covariant technique. A generalized version of the Grodsky - Streater theorem on the infinite degeneracy of mass with spin in the infinite-component field theory is proved.
Author (NSA)

N70-27604# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.

SCATTERING AS A STOCHASTIC PROCESS AT HIGH ENERGIES, PART 1 [RASSEYANIYA PRI VYSOKIKH ENERGIYAKH KAK SLUCHAINYI PROTSESS, CHAST 1]

A. A. Logunov and O. A. Khrustalev 1969 25 p refs In RUSSIAN
(IFVE-STF-69-20) Avail: AEC Depository Libraries

It is shown, that describing the stochastic part of the amplitude with a value-number of particles in an intermediate state necessary (the value, that was not considered earlier) for the transversal momentum transfer, it is possible to describe qualitatively the main properties of the elastic scattering at high energies.
Author (NSA)

N70-27605# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.

SCATTERING AS A STOCHASTIC PROCESS AT HIGH ENERGIES, PART 2 [RASSEYANIYA PRI VYSOKIKH ENERGIYAKH KAK SLUCHAINYI PROTSESS, CHAST 2]

A. A. Logunov and O. A. Khrustalev 1969 22 p refs In RUSSIAN
(IFVE-STF-69-21) Avail: AEC Depository Libraries

The scattering amplitude is studied with the help of previously defined stochastic variable – number of the particles transferring the given transverse momentum.
Author (NSA)

N70-27609# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

COMPARISON OF CONSPIRACY AND CUTS IN NUCLEON-NUCLEON SCATTERING

N. A. Kobylinskii 1969 12 p refs In RUSSIAN; ENGLISH summary Presented at ITF Seminar, Kiev
(ITF-69-69) Avail: AEC Depository Libraries

There have been compared two theoretical models of high-energy nucleon-nucleon and nucleon-antinucleon scattering, claiming to explain the existence of sharp peaks in differential cross sections of the processes proton + antiproton yields neutron + antineutron and proton + neutron yields neutron + proton near t = 0. The model, taking into account both pion trajectory and cuts, corresponding to simultaneous exchange of pion and vacuum poles, describes the differential cross section with nonpolarized particles as good as the model which takes into account the contribution of pion pole and its scalar conspirator. The analysis carried out shows that, on the contrary, these models give different results for polarization of final nucleons.
Author (NSA)

N70-27622# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnoi Fiziki.

CONCERNING THE STABILITY AND FREQUENCIES OF SPATIAL XENON OSCILLATIONS (A LINEAR APPROXIMATION) [OB USTOICHIVOSTI I CHASTOTAKH PROSTRANSTVENNYKH KSENONOVYKH KOLEBANII (LINEINOE PRIBLIZHENIE)]

A. M. Afanasev, B. Z. Torlin, and A. I. Trubenko 1969 24 p refs In RUSSIAN; ENGLISH summary
(ITEF-663) Avail: AEC Depository Libraries

Frequency spectrum of Xe spatial oscillations of the reactor neutron field and the boundary of stability of these oscillations are studied by means of perturbation theory. Only linearized space-time equations in one- and two-group approximations are considered. The frequency spectrum is shown to have both discrete and continuous regions. The solution in the region of discrete spectrum is compared with the exact one.
Author (NSA)

N70-27646# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.

DISTORTED WAVE BORN SERIES FOR ROTATIONAL INELASTIC SCATTERING

R. E. Roberts (MIT, Cambridge) and John Ross (MIT, Cambridge) Jan. 1970 33 p refs
(Contract N00014-67-A-0226-0005; Proj. Squid)
(AD-701710; SQUID-TR-MIT-53-PU) Avail: CFSTI CSCL 7/4

The distorted wave Born series is applied to the problem of rotational inelastic scattering of an atom by a diatomic molecule. The formulation is made in the total angular momentum representation, and for the special but important case of an exponential interaction a simple second-order expression for the degeneracy averaged cross section is derived. Numerical results for two intermolecular potentials compare favorably with exact multi-state calculations. The analytic results (1) show that differences between exact and DW results do not vanish near threshold, (2) show the applicability of the method to molecules heavier than H2, (3) provide a method of assessing the relative order of contributions from various internal states, (4) provide a method of estimating higher order terms in the DWB series. The application of the second-order DWB series to problems with different forms of potentials of interaction requires only a single numerical integration.
Author (TAB)

N70-27656# Texas Univ., Austin.

DETECTION OF INTERNAL CONVERSION ELECTRONS IN CHARGED PARTICLE SPECTRA

C. F. Moore, J. G. Kulleck, W. R. Coker, R. G. Clarkson, J. J. Kent et al [1969] 10 p refs Sponsored in part by AEC
(TID-25300) Avail: CFSTI

Internal conversion electrons were detected using cooled Si(Li) detectors. No effort was made to separate the scattered

electrons and the scattered protons prior to detection. The resolution obtained was typically 4 keV or better. Author (NSA)

N70-27689# Iowa State Univ. of Science and Technology, Ames.
TWO AND THREE PION PRODUCTION WITHOUT ANNIHILATION IN ANTIPROTON-PROTON INTERACTIONS AT 2.4 AND 2.9 GEV/C
Richard Allen Jespersen (Ph.D. Thesis) Nov. 1969 66 p refs
(Contract W-7405-eng-82)
(IS-T-330) Avail: CFSTI

From an analysis of 16,000 four-prong events in antiproton-proton interactions at 2.4 GeV/c and 9400 at 2.9 GeV/c, final samples of 897 and 1015 events, respectively, were accepted as being due to the reaction antiproton-proton yields antiproton-proton positive pion negative pion. The cross section for this reaction is 1.48 + or − 0.07 mb at 2.4 GeV/c and 2.53 + or − 0.10 mb at 2.9 GeV/c. The data at both momenta are consistent with nearly 100% double resonance production. No other resonances were seen and the reaction is peripheral at both momenta. Author (NSA)

N70-27695# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
THEORETICAL SPECTRUM-THRESHOLD DETECTOR DATA CORRELATION IN EBR-2
J. L. Kamphouse, R. L. Stuart, and J. Moteff Sep. 1969 36 p refs
(Contract AT(40-1)-2847)
(GEMP-720) Avail: CFSTI

An experimental and computer program to further examine the neutron environment in the Experimental Breeder Reactor II (EBR-II) was completed. Monte Carlo and S sub 4 Transport methods were used to determine the neutron spectrum at various positions in the EBR-II core and blanket regions. Response functions for the threshold detectors Ni-58(n,p) Co-58 and Fe-54(n,p) Mn-54 were determined for each position and the corresponding predicted induced activities are compared with experimental results. Based on combinations of calculated neutron spectra, experimental detector responses, and cross section end points an empirical differential cross section was determined for the Ti-46(n,p) Sc-46 threshold reaction. Spectrum averaged cross sections for the three threshold reactions which were determined at various positions in this facility suggest that significant errors in fast neutron fluences will result if the usual fission spectrum averaged cross sections are used. Author (NSA)

N70-27697*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
SEARCH FOR UNCHARGED FASTER THAN LIGHT PARTICLES
C. Baltay (Columbia Univ., New York), G. Feinberg (Columbia Univ., New York), N. Yeh (Columbia Univ., New York), and R. Linsker [1969] 23 p refs Supported in part by AEC
(NASA-TM-X-62897; NYO-1932(2)-148) Avail: CFSTI

An experiment has been carried out to search for uncharged particles with spacelike four momentum which presumably travel faster than light. No evidence for such particles has been found. The results can be expressed on upper limits on the production rates for such particles by stopped negative kaons and antiprotons compared to production rates of pions in similar reactions. Other sources of information placing limits on the interactions of tachyons are discussed. Author

N70-27711*# NUS Corp., Rockville, Md.
A CODE TO UNFOLD SCINTILLATION SPECTROMETER POLYENERGETIC GAMMA PHOTON EXPERIMENTAL DISTRIBUTIONS
J. J. Steyn, U. Born, J. T. Strahl, and R. Huang Sep. 1969 132 p refs
(Contract NAS5-10337)
(NASA-CR-109848; NUS-557) Avail: CFSTI CSCL 20H

A FORTRAN code was developed for the IBM-360 digital computer to unfold sodium iodide (thallium-activated) scintillation spectrometer polyenergetic gamma photon experimental distributions. It was specifically designed to analyze the combination bremsstrahlung and monoenergetic gamma radiation field of cylindrical radioisotope power generators. The code generates the detector system response matrix function and applies it to the monoenergetic spectral components discretely and to the bremsstrahlung iteratively. It corrects for iodine K X-ray escape, detector non-linearity, system drift, source decay, background, and detection efficiency. Results are presented in digital form for differential and integrated photon number and energy distributions, and exposure dose. Author

N70-27719# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
STUDY OF ONCE AND TWICE FORBIDDEN BETA TRANSITIONS [CONTRIBUTION A L'ETUDE DE TRANSITIONS BETA UNE FOIS ET DEUX FOIS INTERDITES]
Jean-Claude Hocquenghem (Ph.D. Thesis--Grenoble Univ., 29 Sep. 1967) Dec. 1969 107 p refs In FRENCH; ENGLISH summary
(CEA-R-3455) Avail: CFSTI

Directional angular correlation measurements gave data on beta-gamma angular correlations. These measurements, transitions with the determination of the beta shape-factor, were made for the following transitions: (a) the first forbidden beta beta(-) transitions of 386 keV in the Lu177 disintegration and of 352 keV in the Yb175 disintegration. The experimental results were compared with theoretical predictions from Nilsson's model; (b) the twice forbidden beta(-) transition of 473 keV in the Nb94 disintegration. The beta transition nuclear matrix elements extracted from the experimental results were compared with theoretical values. The nuclear wave functions used were obtained by diagonalisation of the residual interaction and assuming that protons and neutrons outside the Zr90 core are respectively on the 1 g 9/2 and 2 d 5/2 orbits. Author (ESRO)

N70-27727# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
UPPER LIMIT OF THE ELECTRIC DIPOLE MOMENT OF THE NEUTRON
S. Apostolescu, D. R. Ionescu, M. Ionescu-Bujor, S. Meitert, and M. Petrascu 1969 16 p refs
(IFA-NR-30) Avail: AEC Depository Libraries

The neutron magnetic resonance has been used in the determination of the electric dipole moment of the neutron. An improved spectrometer has been used having 1.8 meters distance between the rf coils and an elaborate magnetic shielding consisting in eight strata of ARMCO iron. The electric field was 95 kV/cm. No value of the electric dipole moment could be put into evidence in the limits of the errors, so a value of (minus 0.2 plus or minus 3.9) times 10 to the minus 22nd power cm for mu sub e/e has been established in good agreement with previous results. Author (NSA)

N70-27728# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
ON THE ACCOUNT OF PARTICLES LEAVING THE DETECTOR DUE TO THE MULTIPLE COULOMB SCATTERING
N. I. Kostanashvilli, R. V. Polyakova, and V. A. Yarba 1969 8 p refs In RUSSIAN
(JINR-P-1-4815) Avail: AEC Depository Libraries

The correction is calculated, which takes into account particles leaving detecting systems due to the multiple Coulomb scattering. The method suggested can be applied for the case of large ionization losses. The calculated results for photoemulsion agree well with experimental data. Author (NSA)

N70-27729# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

CORRECTION TO THE VARITION CALCULATION OF THE BINDING ENERGY O 16

V. N. Maksimenko 1969 14 p refs In RUSSIAN; ENGLISH summary Presented at ITF Seminar, Kiev
(ITF-69-74) Avail: AEC Depository Libraries

The calculation of the second order correction of the perturbation theory to the variational binding energy of the nucleus is made for the concrete variant of pair forces which provide for saturation. The allowance for the correction essentially improves the agreement with experiment. The comparison of the calculation results of the correction for the nuclei He-4 and O-16 was made. Author (NSA)

N70-27730# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

CORRECTION OF THE SECOND ORDER OF THE PERTURBATION THEORY TO THE ENERGY OF THE GROUND STATE O 16

G. F. Filippov 1969 15 p refs In RUSSIAN; ENGLISH summary Presented at ITF Seminar, Kiev
(ITF-69-63) Avail: AEC Depository Libraries

The correction of the second order of the perturbation theory to the energy of the ground state of O-16 is calculated. The expression obtained can be used for the quantitative estimate of the exactness of the binding energy of this nucleus which was found by the variational method on the oscillated wave functions. The contribution to the potential energy O-16 from the short range repelling forces with the given scattering length is found. Author (NSA)

N70-27732# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnoi Fiziki.

CONCERNING ONE TYPE OF THE MAGNETIC FOCUSING SYSTEMS WITH COMPENSATED DISPERSION. CONCERNING ACHROMATIZATION OF BEAMS OF PARTICLES IN CASES WHEN THE MAGNETIC ANALYSIS PRECEDES THE LIMITATION OF THE BEAM

V. V. Miller 1969 32 p refs In RUSSIAN; ENGLISH summary
(ITEF-702) Avail: AEC Depository Libraries

Magnetic systems with the compensating magnet transferred to the end of the channel are analyzed. The linear dispersion is compensated at the position of the final image and at the center of that lens of the exit doublet in which the beam has maximum horizontal spread. For these almost achromatic systems, a good transmission for wide bend can be achieved. The deflection angles in the compensating magnet differ by a factor of 3 to 4. This feature permits in some cases two zero dispersion beams at the end of the system, and beam switching from one experimental site to another. Alternatively, one can have beams with compensated or enlarged dispersion without loss of the intensity. Also, it is shown, that if the analyzing magnet is placed before the aperture slit, the usual achromaticity condition results in spreading of the beam in the exit doublet. The current in the field lens must be adjusted to make the trajectory, crossing the center of the aperture slit, coincide with the axis of the system at its exit. In this case in linear approximation the cross section of the beams with all values of p will coincide in the exit doublet. Author (NSA)

N70-27738# Tubingen Univ. (West Germany). Inst. fuer Theoretische Physik.

A CALCULATION FOR THE 3/2(+) RESONANCE OF HE 5 [EINE RECHNUNG ZUR 3/2(+)-RESONANZ DES HE 5]

P. Heiss Nov. 1969 64 p refs In GERMAN
(BMwF-FBK-69-38) Avail: AEC Depository Libraries

In the framework of the cluster model a method for the calculation of light nuclei scattering states is presented. Starting from simplified nucleon-nucleon forces it was possible to describe the 3/2 positive state of He-5 and especially the He-4nD-3/2 resonance. Author (NSA)

N70-27750# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.

THE BEHAVIOUR OF RADIOACTIVE ISOTOPES IN LIQUID METAL COOLED FAST REACTORS. PART 2: AN INVESTIGATION OF ADSORPTION OF Cs AND Ba ISOTOPES FROM SOLUTION IN LIQUID SODIUM

H. E. Evans and W. R. Watson Jan. 1970 20 p refs
(RD/B/N-1513) Avail: AEC Depository Libraries

Adsorption of Cs and Ba isotopes on a variety of materials from sodium was studied in the temperature range 25 to 600 C using a gamma-tracer technique. No adsorption of Cs on metal foils was detected and the apparent adsorption of Cs-137 reported elsewhere is attributed to adsorption of its metastable daughter nuclide Ba-137m. Adsorption of Cs-137 on graphite was confirmed. Author (NSA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N70-28519# Princeton Univ., N.J. Plasma Physics Lab.

GENERATION OF HIGH-FREQUENCY NOISE AND ION PLASMA OSCILLATIONS WITH LANGMUIR PROBE IN A MAGNETICALLY CONFINED PLASMA

Junji Fujita Dec. 1969 35 p refs
(Contract AT(30-1)-1238)
(MATT-743) Avail: CFSTI

High-frequency noise (40 to 500 MHz) was found to be generated by the electron current to a Langmuir probe in a plasma of Etude Stellarator when the probe bias is above some critical voltage. This point is close to the space potential determined from probe characteristics. The frequency spectrum of this noise during discharge pulse is broad and has an upper limit around omega sub pi, while the noise observed in the afterglow plasma lies at clearly defined frequencies close to omega sub pi and its higher harmonics (approximately 5 omega sub pi). Oscillations are well described on the basis of the excitation of the ion waves by the probe current itself. The observation of the onset of this noise or the frequencies of the noise generated in an afterglow may be useful for finding out either space potential or the exact decay of local plasma density. Author (NSA)

N70-28546 Stevens Inst. of Tech., Hoboken, N.J.

STUDIES OF FLUTE-LIKE INSTABILITIES IN A MAGNETOPLASMA

Gilbert Arthur Emmert (Ph.D. Thesis) 1969 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-21287

Studies of flute like instabilities in a magnetoplasma are presented in three parts. The finite gyroradius fluid-like equations

for a low-beta plasma are derived from guiding-center theory, with finite gyroradius modifications. The result indicates that guiding-center theory, with finite gyroradius modifications, is applicable to low frequency instabilities if the wavelength and characteristic lengths of the system are larger than the gyroradius. The eigenvalue equation describing the flute instability in the presence of a nonuniform electric field is studied. It is found that the plasma is stable if the macroscopic "drift" velocity exceeds a critical value. A necessary and sufficient condition for an instability of very long wavelength is presented. The effect of dispersion in the particle distribution function on the plasma flute instability is considered. A dispersion relation is derived and analyzed. The growth rates and stability limits found differ from those predicted by the gravitational model. An instability due to the temperature gradient is found; it persists even for favorable (minimum B) curvature. In addition, a short wavelength instability is found for the case of weak favorable curvature in a high density plasma. Dissert. Abstr.

N70-26585# Sandia Corp., Albuquerque, N.Mex.
TIME-DEPENDENT COLLISIONLESS PLASMA SHEATH
J. W. Poukey Dec. 1969 33 p refs
(SC-RR-69-836) Avail: CFSTI

A collisionless, fully ionized plasma located between two infinite plane walls is investigated by means of computer simulation. Since there are no sources of ionization, the plasma is eventually all lost to the walls, the loss being greatly inhibited by the positively charged negative-potential sheath which forms near the walls. The solutions depend on three parameters: the ratios of Debye length to system size, electron temperature to ion temperature, and ion mass to electron mass. Certain aspects of the solutions, such as the sheath structure, diffusion cooling, and the current to the wall, are considered in detail. Author (NSA)

N70-26668# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
INTERACTION OF A PLASMA BEAM WITH A PLASMA CYLINDER IN THE MAGNETIC FIELD OF DIVERTER
V. G. Zykov et al Jan. 1970 9 p refs Transl. into ENGLISH from the Russian Report FTI-167
(AEC-TR-7105; FTI-167) Avail: CFSTI

Penetration of plasma beams (moving across the magnetic field of a divertor) into the hollow cylinder formed near the divertor surface as a result of plasma injection, was studied by means of electric probes, a plasmascope, and Thomson mass spectrograph. It was found that the front part of the plasma beam penetrated inside the divertor aperture; the tail part stayed on the periphery due to polarization from interaction with the plasma cylinder. Author (NSA)

N70-26699# Princeton Univ., N.J. Plasma Physics Lab.
SYNCHROTRON RADIATION FROM FUSION REACTORS
R. G. Mills Dec. 1969 26 p refs
(Contract AT(30-1)-1238)
(MATT-658) Avail: CFSTI

Early studies of synchrotron radiation in plasmas concentrated on hypothetical D–D reactors in which the synchrotron radiation losses would be quite severe. Losses from an assumed D–T plasma are far less. Nevertheless, they could become important in machines where beta must be small. There exist critical radii and critical beta's below which radiation losses would exceed the fusion energy released to charged particles within the plasma from fusion reactions. An economic reactor should operate with conditions exceeding these levels. For D–T, if the electron temperature is less than 50 kV and the plasma radius is greater than 100 cm, the critical beta is less than 0.01. For most plasma conditions postulated for thermonuclear reactors, the synchrotron radiation will be less than bremsstrahlung. Author (NSA)

N70-26700# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
TURBULENT HEATING OF PLASMA IONS DURING THE DEVELOPMENT OF ELECTRON-ACOUSTIC INSTABILITY
V. L. Sizonenko et al Jan. 1970 27 p refs Transl. into ENGLISH from the Russian Report FTI-218
(AEC-TR-7115; FTI-218) Avail: CFSTI

Studies of weak turbulence in plasma with hot ions and cold electrons revealed that small-scale hf electron–acoustic instabilities developed by ion motion relative to electron motion in the electric field. Ion scattering by electron–acoustic oscillations resulted in increases, transverse in relation to the external magnetic field, of the thermal energy of the ions. Expressions are derived for the spectral intensity of electron–acoustic fluctuations, taking into account their nonlinear self-interactions, and a quasi-linear equation was developed for the background function of ion distribution determining turbulent ion heating. The time span of heating was also found. Experiments were performed on plasma heating by ion-cyclotron and fast magneto-acoustic waves, in which abnormal wave absorption was observed. The observed abnormality was due to excitation of a plasma beam instability in the electric field of these waves and, in particular, by excitation of electron–acoustic instabilities. Author (NSA)

N70-26712*# Brown Univ., Providence, R.I.
ESTIMATED ION MOBILITIES FOR SOME AIR CONSTITUENTS
E. A. Mason [1969] 17 p refs
(Grants NsG-5-59; NGR-40-002-059)
Avail: CFSTI

Estimates, based on available experimental data and on theory, are given for the mobilities of the ions O(+), N(+), O2(+), and NO(+) in the neutral species He, O, N, O2, and N2 from 0 deg to 2500 K. Author

N70-26733# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
MAGNETIC CONFIGURATIONS WITH A SHEAR AND MINIMUM ANTI B
V. F. Aleksin et al Jan. 1970 20 p refs Transl. into ENGLISH from the Russian Report FTI-217
(AEC-TR-7116; FTI-217) Avail: CFSTI

Studies were made of a magnetic configuration of one-, two-, and three settings of the helical field (n = 1, 2, and 3) with axial current. Properties of rotational transformation of magnetic lines of force and magnetic field minimum at the center were examined. A relationship was established for the well and width and the particularities of the structure configuration. Numerical data were obtained for the width and relative depth of wells for each magnetic system (n = 1, 2, and 3). Author (NSA)

N70-26833# ARO, Inc., Arnold Air Force Station, Tenn.
TRANSITION PROBABILITIES OF ARGON 2 Final Report, 1967–1969
Eugene D. Tidwell Feb. 1970 23 p refs
(Contract F40600-69-C-0001)
(AD-700979; AEDC-TR-70-18) Avail: CFSTI CSCL 20/9

With the use of two stable, highly ionized argon plasma sources, over 200 spectral lines have been measured and identified. Of these, 70 or more have been used for transition probabilities after they were found to be single, unperturbed argon ion (ArII) lines. Each line has been tested for abnormal half-widths; those with widths greater than 20 percent over normal are not used. Excitation temperatures from 1 to 8 ev (kTe) have been used: (1) photographically with a 1.5-m focal length spectrograph and (2) photoelectrically with a 0.5-m spectrometer. As many as 33 observations have been tabulated for the stronger lines. All lines have upper state energy values between 19 and 24.5 ev and lie

between 3500 and 5100 A. The absolute intensity of the 4589 A ArII line produced a density which agreed well with calculated local thermodynamic equilibrium conditions at P = 340 micro HG and kT(e) = 1 ev. The tables and figures include wavelengths, energy states, estimated uncertainty, statistical weights, transition probabilities, and number of observations. Examples of the Maxwell-Boltzmann distributions are shown. Author (TAB)

N70-26870# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.

THE SAWTOOTH COLUMN OF THE SUPERSONIC ELECTRIC ARC IN SULFUR HEXAFLUORIDE

Charles E. Bond (Illinois Univ.) Dec. 1969 32 p refs

(Contract N00014-67-A-0226-0005; Proj. SQUID)

(AD-700715; SQUID-TR-ILL-20-PU) Avail: CFSTI CSCL 20/9

A fine sawtooth structure is reported for the slanted supersonic electric arc in sulfur hexafluoride. This structure results in an apparent crossflow Mach number for the arc column which can be considerably higher than the actual crossflow Mach number. Experimental observations indicate that for arc Mach numbers from 1.3 to 5.4, the actual crossflow Mach number is very nearly equal to unity. Two models for the sawtooth column are considered. Agreement is found between the sawtooth models and experimental observations. Implications for the mechanism of column slanting are discussed. Author (TAB)

N70-26874# Stichting Voor Fundamenteel Onderzoek Der Materie, Jutphaas (Netherlands). Inst. Voor Plasma-Fysica.

AN UNFOLDING PROCEDURE FOR STARK AND DOOPLER BROADENED HE2 LINES

R. F. De Vries Aug. 1969 31 p refs Sponsored in part by Euratom *Its* Rijnhuizen Rept. No. 69-54

(NP-18086) Avail: AEC Depository Libraries

Mechanisms that may lead to broadening of spectral lines emitted by a plasma were surveyed. Spectral line profiles are described with generalized Voigt functions; an unfolding procedure is given with the aid of these generalized Voigt functions. The functions are applied to the profile of the ionized helium line lambda 4686A. Spectral-line intensity distributions of a Fabry–Perot interferogram are analyzed. A method is developed for deriving electron densities and ion temperatures from the simultaneously measured halfwidths of two strong lines of ionized helium in the visible (lambda 4686A) and near-uv region (lambda 3203A). Results of measurements on a theta pinch are given. NSA

N70-26909# Stichting Voor Fundamenteel Onderzoek Der Materie, Jutphaas (Netherlands). Inst. Voor Plasma-Fysica.

RADIAL OSCILLATIONS OF A MAGNETIZED PLASMA CYLINDER IN PRESSURE EQUILIBRIUM WITH A COLD GAS BLANKET

L. C. J. M. De Kock Dec. 1968 11 p refs Sponsored by Euratom

(NP-17879; Rept-68-49) Avail: AEC Depository Libraries

A magnetized plasma cylinder in pressure equilibrium with a cold gas blanket oscillates radially with a series of eigenfrequencies starting in the 10 kHz region. It is shown that these low frequencies are not suited to excite magnetoacoustic oscillations, since the amplitude of oscillation is low in the plasma region. Only at certain high frequencies modes of oscillation have been found at which energy can be supplied to the plasma cylinder. Author (NSA)

N70-26928# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.

A NUMERICAL STUDY OF THE INDUCTIVE ELECTRODELESS DISCHARGE, JUNE 1968 – JUNE 1969

D. C. Pridmore-Brown 15 Nov. 1969 25 p refs

(Contract F04701-69-C-0066)

(AD-700753; TR-0066(5220-50)-8; SAMSO-TR-70-12) Avail: CFSTI CSCL 20/9

A numerical study is reported of the equations describing the steady-state of a column of thermal plasma that is heated inductively by a radio frequency axial magnetic field. The electric and thermal conductivities and the specific radiation of the plasma are taken to be given functions of the temperature. A numerical technique is described which yields self-consistant solutions for given values of the input parameters, these being the frequency and the number of ampere turns per unit length of the driving solenoid, and the radius of the tube. Typical results are shown for an argon plasma at atmospheric pressure. It is found that the solutions are very sensitive functions of the values on the axis and in general are not unique. Author (TAB)

N70-26984# Technische Hochschule Hannover (West Germany). Inst. fuer Plasmaphysik.

ON THE FORMATION OF THE INNER CHANNEL IN AN EXPLODING WIRE DISCHARGE AT HIGH AMBIENT PRESSURE [ZUR ENTSTEHUNG DES INNEREN ENTLADUNGSKANALS BEI EINER DRAHTEXPLOSION UNTER HOHEM UMGEBUNGSDRUCK]

R. Binder Bundesministerium fuer Wiss. Forsch. Oct. 1969 39 p refs In GERMAN; ENGLISH summary

(BMwF-FBK-69-35) Avail: AEC Depository Libraries

An exploding wire discharge of a very thin tungsten wire (d = 0.01 mm) in nitrogen at high pressure (p = 100 atm) is investigated. The total radiated power of the discharge channel is determined from measurements of the absolute spectral radiant intensity in the near ultraviolet using absorption coefficients for the vacuum uv region calculated by Armstrong. About one half of the radiation energy emitted by the plasma column is absorbed in the cold ambient gas producing an intense photoionization. This process essentially brings about the growth of the discharge channel. Strong self-absorption of radiation in the plasma column effects a partial screening of the plasma near the axis against radiation energy loss. Author (NSA)

N70-27008# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

INTERACTION OF MOVING PLASMA WITH AN OBLIQUE MAGNETIC FIELD

V. S. Voytsenya et al Jan. 1970 14 p refs Transl. into ENGLISH from the report NP-17664

(AEC-TR-7113; NP-17664) Avail: CFSTI

The interaction of a moving plasma cluster in a magnetic trap with the magnetic field, when the plasma moves at an acute angle with respect to the direction of the field, presents an as yet unresolved problem. Such a situation arises when plasma streams are injected into a closed trap, as in the case of the stellarator or a trap with combined fields. The interaction of the plasma with its confining field may be mocked up by the interaction of plasma clusters with an oblique field. The problem was studied by using the draft approximation for analyzing the motion of the plasma in the oblique field; a transverse field applied onto the constant field of the solenoid was used to obtain a magnetic field directed at an acute angle with respect to the direction of the injection. The results indicated that in such an oblique field the plasma diverges from its original direction, creating cut-off plasma clusters. If the duration of the transverse field is reduced, the plasma may be completely occluded, resulting in the absence of probe signals; the calorimetrically determined energy was found to amount to about 0.1 of the energy measured with an applied transverse field. Author (NSA)

N70-27008# Aerospace Research Labs. Wright-Patterson AFB, Ohio.

DETERMINATION OF THE TRANSVERSE MOMENTUM EXCHANGE PER UNIT ARC LENGTH Final Report

Herbert O. Schrade and Salvatore F. Giannotta Nov. 1969 17 p refs Presented at the 9th Intern. Conf. on Phenomena in Ionized Gases, Bucharest
(AD-701727; ARL-69-0192) Avail: CFSTI CSCL 20/9

For any arbitrarily shaped, stationary curved arc column in an externally applied magnetic field, the momentum exchange per unit arc length and unit time through the arc surface area is counteracted by the Maxwell stress tensor over the same surface area. It is argued that this local balance of forces is independent of the forces on the endplanes of the entire discharge column. After determining the total magnetic field at a distance r from the axis, one can calculate the transverse components of the momentum exchange to a first order approximation. This is done by substituting the magnetic field components into the expression for the Maxwell stress tensor and then integrating over the arc surface element. Final expressions for the two transverse components are given. Author (TAB)

N70-27021# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
STABILITY OF HIGH-FREQUENCY OSCILLATIONS IN ARBITRARY PLASMA CONFIGURATIONS Scientific Report
Siegbert Kuhn 24 Dec. 1969 28 p refs
(Contract F61052-67-C-0014)
(AD-701401; UNICP-SR68; AFOSR-70-0391TR) Avail: CFSTI CSCL 20/9

The paper deals with the application of a theory devised by Taylor and Hastie to the range of high-frequency oscillations in a fully ionized plasma. The shapes of both the perturbances and the equilibria on which they are superimposed are left geometrically arbitrary, and collisions are accounted for by means of a Krook-type collision term. The linearized Boltzmann equation is solved for the perturbed distribution function in the lowest order with respect to a small expansion parameter, and a generalized dispersion relation is derived by means of Poissons equation. Then Nyquist plots are used to determine whether or not this relation is satisfied for some omega located in the unstable lower omega half-plane. Important general properties of the relevant Nyquist plots are stated, and a more detailed expression is given for the collisionless case. Author (TAB)

N70-27022# Space Sciences, Inc., Waltham, Mass.
AN RF COIL SYSTEM FOR THE MEASUREMENT OF PLASMA ELECTRICAL CONDUCTIVITY
Sol Aisenberg and Kuo W. Chang Oct. 1969 30 p refs /its Scientific-1
(Contract F19628-68-C-0127)
(AD-701399; AFCRL-70-0033) Avail: CFSTI CSCL 20/9

An improved conductivity probe system has been designed and constructed for the measurement of plasma electrical conductivity of re-entry vehicles and for the use in conductivity measurements of simulated re-entry plasmas in the laboratory. The system involves the use of a marginal oscillator to measure the change of coil Q and INDUCTANCE' Since the marginal oscillator is always on resonance and is quite sensitive to slight changes in Q, this approach is far superior to the impedance bridge method for measuring the change of coil impedance. The conductivity coil system was calibrated over a wide dynamic range of about 8 orders of magnitude of conductivity using silicon slices for calibration over the intermediate portion of the range. The operating range of the system was shown to cover the transition region where the skin depth is comparable to the soil diameter. The conductivity coil system also permits the measurement of frequency shift which itself can be calibrated in terms of the conductivity of the plasma assuming the reactive current in the plasma is small. An automatic gain control was added to the system in order to compensate for the slow changes of operating point due to temperature or aging. Author (TAB)

N70-27025# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
NORMAL MODES FOR DRIFT WAVES IN ADIABATIC PLASMAS
Gerhard Auer 20 Dec. 1969 20 p refs
(Contract F61052-67-C-0014)
(AD-701402; UNICP-SR69; AFOSR-70-0390TR) Avail: CFSTI CSCL 20/9

The normal modes for electrostatic waves in an inhomogeneous low-beta plasma are investigated under the assumption of adiabatic oscillations. A two-fluid model is used and electron inertia and finite electrical conductivity are taken into account. The dispersion relation obtained is discussed for the limits of perpendicular and nearly parallel propagation, respectively, with respect to the magnetic field. For small parallel wavenumbers the dispersion relation is discussed numerically and dispersion curves are obtained. It is found that the modes present in an isothermal plasma are only slightly changed. Besides them two new drift waves occur which are stable according to linear theory. For sufficiently large parallel wavenumbers they go over into acoustic waves. Author (TAB)

N70-27049# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDRODYNAMICS OF MHD DEVICES EMPLOYING LIQUID METALS
O. A. Lielausis 15 Oct. 1969 133 p refs Transl. into ENGLISH of the book "Gidrodinamika Zhidkometallicheskikh Mgd-Ustroistv" Riga, Zinatne, 1967 p 1–196
(AD-700603; FTD-HT-23-106-69) Avail: CFSTI CSCL 13/11

The book is intended to be a basic guide for designers of magnetohydrodynamic devices. Calculations of these devices, basically treated as a variety of hydraulic machines, are compared with electrodynamic and electrotechnical calculations. Author (TAB)

N70-27052# Avco-Everett Research Lab., Everett, Mass.
PROPERTIES OF COLLISIONLESS PLASMAS Final Report
R. M. Patrick Jan. 1970 46 p refs
(Contract AF 49(638)-1483)
(AD-701442; AFOSR-70-0388TR) Avail: CFSTI CSCL 20/9

A plasma wind tunnel was developed which, for the first time, created a steady flow (for times in excess of one millisecond) of collision-free plasma. This plasma has a transport-free path which is very long compared to the flow dimensions (one meter); however, the gyro radii of the ions and electrons in the flow are small compared to the flow dimension. This apparatus was used where the plasma flow pressure was large compared to the magnetic field in the plasma, allowing the study of flows where the plasma speed was greater than the local Alfven speed in the flow. This is necessary to study stationary shock structure, since a super-Alfvenic flow is required to produce plasma shock waves. A high PRESSURE Magnetic Annular Arc (MAARC) facility was constructed to test the feasibility of increasing the stagnation pressure of an ultra-high-speed gas flow (velocities in excess of 25,000 ft/sec). The stagnation pressure in a nitrogen flow was increased from 2 atm to nearly 10 atm. This device operates at a power level equal to 20 million watts and has an anode bore equal to 5 cm, demonstrating the successful use of magnetic fields to control heat transfer and create useful body forces. The magnetic annular arc technology was also used to produce high speed shocks in a conventional shock tube. This was done using a standard 4-cm bore shock tube, and collisional shock waves with speeds in excess of 20,000 m/sec were obtained. Author (TAB)

N70-27163# Technische Hochschule Hannover (West Germany). Inst. fuer Plasmaphysik.
EXPERIMENTAL INVESTIGATION OF THE CONTINUOUS EMISSION OF SHOCK HEATED ARGON [UNTERSUCHUNG DES EMISSIONSKONTINUUMS VON ARGON AM MEMBRANSTOSSWELLENROHR]

H. Roders Oct. 1969 69 p refs In GERMAN
(BMwF-FBK-69-28) Avail: AEC Depository Libraries

For the production of argon plasma, a diaphragm shock tube was developed in which the driver gas is heated by a powerful electrical discharge. Using this technique, it was possible to measure the continuum radiation behind the incident shock wave photographically. The emission coefficient and the xi factor of argon 1 were determined in the wavelength region between 4000 and 6000 A. The results are compared with measurements and theoretical calculations of other studies. Author (NSA)

N70-27302*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISCREPANCIES IN THE OBSERVED PLASMA-TROUGH DENSITY
E. J. R. Maier and G. P. Serbu Mar. 1970 14 p refs
(NASA-TM-X-63905; X-621-70-77) Avail: CFSTI CSCL 20I

Observations of the plasmapause have now been achieved by a variety of techniques: ground based reception of Whistlers, in-situ observations by mass spectrometers, retarding analyzers, and VLF receivers. Comparisons of some of these observations are made, and it is concluded that the details of the plasmasphere boundary and the thermal plasma density beyond the plasmasphere are more variable than the idealized plasma-sphere model would suggest. Author

N70-27305# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
AN EXPERIMENT ON CYCLOTRON RESONANCE HEATING OF IONS AND ELECTRONS IN A PLASMA Final Report
G. Cattanei, A. C. England (Oak Ridge Natl. Lab.), and G. Siller Aug. 1969 18 p refs
(IPP-2/81) Avail: CFSTI

Some results of an experiment in which ions and electrons were to be heated independently at the respective cyclotron resonance frequency are described. The experiment was shut down before systematic measurements could be made, and the behaviour of the plasma could only be qualitatively determined. Author (ESRO)

N70-27382*# Scientific Translation Service, Santa Barbara, Calif.
ACCELERATION OF CHARGED PARTICLES IN THE INTERPLANETARY PLASMA [USKORENIYE ZARYAZHENNYKH CHASTITS V KOSMICHESKOY PLAZME]
M. Ya. Kats et al Washington NASA May 1970 7 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 14, no. 6, Jun. 1969 p 1019–1022
(Contract NASw-2035)
(NASA-TT-F-12973) Avail: CFSTI CSCL 20I

The nature of the second peak of fast protons which appears after the coming of a diffusive wave from a solar flare is discussed. The presence of the fast proton peak is connected with acceleration of particles by fluctuation fields in the interplanetary plasma. Author

N70-27389# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Energiewandlung und Elektrische Antriebe.
COLLISION-DOMINATED SHEATH IN WEAKLY IONIZED PLASMAS, PART 2 [STOSSBESTIMMTE GRENZSCHICHT IN EINEM SCHWACHIONISIERTEN PLASMA, TEIL 2]
Peter Wahle and Karl Gerhard Mueller (Bonn Univ.) Dec. 1969 96 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-78) Avail: CFSTI

Having discussed the macroscopic collision-dominated sheath models in the first part, a microscopic sheath model which fulfils the exact boundary conditions at the wall was developed. The momentum transport equations of the charge carriers were modified and the specular reflection of the electrons was included. When a suitable coefficient is introduced in the macroscopic boundary condition of the electrons the macroscopic description agrees with the microscopic models and the former are seen to represent extreme cases of the microscopic model. Density and potential distributions in the sheath and the current-voltage characteristics were calculated for various values of the pertinent parameters. Author (ESRO)

N70-27397# Princeton Univ., N.J. Plasma Physics Lab.
SPHERATOR AND RELATED EXPERIMENTS
S. Yoshikawa Dec. 1969 31 p Presented at the Intern. Symp. on Closed Confinement Systems, Dubna, USSR, 29 Sep.–3 Oct. 1969
(Contract AT(30-1)-1238)
(MATT-735; CONF-690931-2) Avail: CFSTI

A review of spherator experiments at Princeton and the summary of the present hypothesis in regard to plasma loss across the magnetic field were discussed. A schematic diagram of the spherator is shown. Three main coils are required. The internal ring provides the poloidal magnetic field. The resulting field pattern has magnetic surfaces, and one expcts it to have both a minimum-average-B configuration and a high sheer. The plasma is made around the center conductor. By inserting a probe from the outside, one expects to find that the density peaks and then goes to zero as it reaches the center conductor. Author (NSA)

N70-27403 France. Ministere de l'Air, Paris. Centre de Documentation de l'Armement.
INVESTIGATION OF COMPLEX PLASMA CONDUCTIVITY AT LOW FREQUENCIES [ETUDE DE LA CONDUCTIBILITE COMPLEXE DU PLASMA AUX BASSES FREQUENCES]
A. F. Aleksandrov et al Jan. 1970 12 p refs Transl. into FRENCH from Izv. Vyschikh Uchebn. Zavedenii. Radiofiz., v. 1, no. 10, 1968 p 1544–1547 In FRENCH and RUSSIAN
(Trans-0278) Copyright. Avail: Issuing Activity

This report describes an experiment with a plane condenser in a plasma in which the plate potential was kept at that of space charge. The variations of the impedance components as functions of the plasma parameters when the field frequency was much less than the plasma frequency were determined, and the results agreed with those obtained by other methods. ESRO

N70-27439# Academy of Sciences (USSR), Moscow. Inst. of Physics.
INTRODUCTION TO THE STATISTICAL THEORY OF NONLINEAR PARTICLE-WAVE INTERACTIONS IN PLASMA, PART 1
L. M. Kovrizhnykh 1968 73 p refs In RUSSIAN *Its* Preprint No. 117
(NP-17885-Pt-1) Avail CFSTI

The theoretical aspects and general theory of statistical interactions of charged particles and waves in plasma and the development of the basic equations for a weakly turbulent plasma are discussed. NSA

N70-27483*# National Aeronautics and Space Administration, Washington, D.C.
PHOTON ABSORPTION AND RADIATION OF NONEQUILIBRIUM PLASMA OF FINITE VOLUME IN LINES WITH DOPPLER BROADENING [POGLOSHCHENIYE FOTONOV I IZLUCHENIYE NERAVOVESNOY PLAZMY KONECHNOGO OB'YEMA V LINIYAKH S DOPPLEROVSKIM USHIRENIYEM]
M. B. Chelnokov May 1970 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), no. 9, 1969 p 54–59
(NASA-TT-F-12975) Avail: CFSTI CSCL 20I

The absorption of photons in a plasma of finite volume for the spherical geometry model is examined. The radiation of a plasma confined in a cylindrical volume is obtained in the two-hemisphere approximation. Author

N70-27495 France. Ministere de l'Air, Paris. Centre de Documentation de l'Armement.
INVESTIGATION OF SPACE CHARGE LAYERS BY THE PLASMA CAPACITOR METHOD [ETUDES DES COUCHES DE CHARGE D'ESPACE PAR LA METHODE DU CONDENSATEUR A PLASMA]
A. F. Aleksandrov et al Jan. 1970 17 p refs Transl. into FRENCH from Izv. Vyschikh Uchebn. Zavedenii Radiofiz., v. 11, no. 10, 1968 p 1548–1553 In FRENCH and RUSSIAN
(Trans-0279) Copyright. Avail: Issuing Activity

The results of the thickness of a space charge layer near electrodes immersed in a plasma are presented. The measurements were made by the plasma capacitor method and the dependence of dc on the electrode potential V and the plasma parameters was investigated. Good quantitative agreement with theory was obtained so long as the ion free path and mobility regime were satisfied in the layer. Measurements of dc as a factor of of the charged particle density did not agree with theory, but can be explained by secondary processes. ESRO

N70-27530# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Technische Physik.
EVALUATION OF THE DIFFUSION AND HEAT TRANSPORT COEFFICIENTS OF A NEAR EQUILIBRIUM MANY-TEMPERATURE GAS MIXTURE IN A STEADY ELECTROMAGNETIC FIELD FOR THE CASE OF A PARTIALLY IONIZED FOUR-COMPONENT PLASMA WITH AN ELEVATED ELECTRON TEMPERATURE [DIE AISWERTUNG DER DIFFUSIONS- UND WAERMETRANSPORTKOEFFIZIENTEN EINES EINES GLEICHGEWICHTSNAHEN MEHRTEMPERATUREGAS-GEMISCHES IM STATIONAEREN ELEKTROMAGNETISCHEN FELD FUER DEN FALL EINES PARTIELL IONISIERTEN VIERKOMPONENTENPLASMAS MIT ERHOEHTER ELEKTRONENTEMPERATUR]
H. A. Claassen Nov. 1969 54 p refs In GERMAN
(JUL-623-TP) Avail: CFSTI

Generalized formula for the diffusion and thermal transport coefficients in a near-equilibrium gas mixture are specialized to the case of a four-component mixture. The Chapman-Cowling integrals are investigated for spherical-symmetric interaction potentials of the colliding particles. The simplified expressions for the Ohm and Fourier law are derived. The electron temperature is considered to be higher than the temperature of the heavy components. Author (ESRO)

N70-27598# Joint Publications Research Service, Washington, D.C.
INTRODUCTION TO THE STATISTICAL THEORY OF NONLINEAR PARTICLE-WAVE INTERACTION IN A PLASMA
L. M. Kovrizhnykh AEC 1969 103 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Moscow Preprint No. 117, Pt. 1 and 2, NP-17885-Pt-1 and NP-17885-Pt-2 Prepared for AEC
(AEC-tr-7129; NO-17885-Pt-1; NP-17885-Pt-2) Avail: AEC Depository Libraries

A general theory of the statistical interaction of charged particles and waves in a plasma and a derivation of the basic equations for the weakly turbulent plasma are given. The application of these equations to concrete problems of the physics of a weakly turbulent plasma is discussed. The interaction of radiation with a turbulent plasma and the solution of the nonlinear problem instability of a nonisothermal plasma are described. NSA

N70-27607# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Leningrad (USSR).
TURBULENT HEATING OF PLASMA IN DISCHARGES WITH SKINNED CURRENT
L. V. Dubovoi and V. P. Fedyakova 1969 21 p refs In RUSSIAN; ENGLISH summary
(NP-18106) Avail: AEC Depository Libraries

Results of experimental study of turbulent plasma heating effectiveness in rf discharges with skinned current are reported. On the assumption that in the skin-layer region, ion–acoustic instability develops, the calculation scheme of plasma heating effectiveness, in such type systems is created, which takes into account the discharge current dissipation in turbulent plasma and transfer phenomena accompanying the energy dissipation of rf fields in a direction perpendicular to the external magnetic field. Applicability of concepts developed in this work to the case of turbulent-plasma heating by single current pulses of short-time duration is discussed. Author (NSA)

N70-27610# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
TO THE ECHO THEORY IN PLASMA
A. G. Sitenko, Nguyen Van Trong, and V. N. Pavlenko 1969 19 p refs In RUSSIAN; ENGLISH summary Presented at ITF-Seminar, Kiev
(ITF-69-68) Avail: AEC Depository Libraries

Echo effects in plasma are considered, conditioned by the undamped character of the distribution function of vibrations originating under the influence of perturbations, shifted in time. A case of two exterior perturbations is considered. The high- and low-frequency echo vibrations, originating in plasma under the influence of exterior charges were investigated, particular consideration being given the echo effects related to the vibration transformation. It is shown that in plasma there are possible echo phenomena related to the vibrations, whose dispersion is determined by the character of the distribution function exterior perturbations. The echo vibrations in nonequilibrium plasma are considered in which there is the directed motion of particles. It is shown that repeated excitation in plasma of the highly damping short-wave vibrations can be accompanied by the emergence of the long-wave echo vibrations, resulting in instability. Author (NSA)

N70-27623# Princeton Univ., N.J. Plasma Physics Lab.
RATES OF ELECTRON IMPACT TRANSITIONS BETWEEN EXCITED STATES OF HELIUM
L. C. Johnson and E. Hinnov Jul. 1969 33 p refs
(Contract AT(30-1)-1238)
(MATT-610) Avail: CFSTI

Measurements of electron densities and population densities of excited states of neutral helium are presented for afterglows in the C stellarator. Electron densities range from 10 to the 11th power/cu cm to 3 × 10 to the 13th power/cu cm and electron temperatures from 0.04 to 1 eV. Semiempirical cross section formulas for transitions among excited levels are deduced by comparing observed excited-state population densities with solutions of detailed transition rate equations. The agreement between computed and measured values is good when the assumed cross sections are comparable with impact parameter approximation results and poor, especially at low electron densities and temperatures, when classical cross sections are assumed. Author (NSA)

N70-27634# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst fuer Elektrische Antriebe und Energieversorgung.
DEVELOPMENT OF A MERCURY VAPORIZER FOR AN ELECTROSTATIC ION-THRUSTOR [ENTWICKLUNG EINES QUECKSILBER-VERDAMPTERS FUER ELEKTROSTATISCHE IONENANTRIEBE]

Hans-Juergen Arlt, Joachim Friedrich, and Hinrich J. Junge Dec. 1969 26 p refs In GERMAN; ENGLISH summary
(DLR-MITT-69-28) Avail: CFSTI

The design and manufacture of a mercury vaporizer for electrostatic ion-thrustors is described and the manufacturing technological difficulties are explained. The development resulted in a prototype electron beam welded vaporizer made of molybdenum with a porous tungsten diaphragm. A characteristic curve is given for this vaporizer within the required mercury mass flow range of the ion-thrustor ESKA 18. Author (ESRO)

N70-27721# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Kernverfahrenstechnik.
CALCULATION OF THE NEUTRON EMISSION OF A D-T PLASMA PRODUCED WITH A CAVITY-PINCH DISCHARGE [BERECHNUNG DER NEUTRONENEMISSION EINES MIT EINER HOHLPINCHENTLADUNG ERZEUGTEN D-T-PLASMAS]
R. G. A. Frank Jun. 1969 47 p refs In GERMAN
(KFK-992) Avail: AEC Depository Libraries

A differential equation system was formulated to describe the electron and ion temperatures of a plasma layer. By addition of a pressure term in the motion equation, the collapse of the plasma cavity cylinder to a cylinder was significantly affected. The plasma temperatures were determined in the starting phase after the ignition of the discharge primarily by ohmic heating of the electrons and during the collapse by the adiabatic compression of the plasma. Considering ohmic heating and the varying layer thickness, the cavity pinch process in a wide range was independent of the initial temperature and the initial layer density. The calculation of the neutron number emitted by the plasma was then possible. The conditions for maximum neutron production are given. The effects of the variation of the initial radius at different capacities, variation of the height of the cavity cylinder, variation of the supply voltage, and variation of the initial wall intensity on the optimization of the neutron yield were studied. Processes at the beginning of the discharge were qualitatively analyzed. NSA

N70-27733# Joint Publications Research Service, Washington, D.C.
EQUILIBRIUM AND STABILITY OF A CURRENT PLASMA IN TOROIDAL SYSTEMS [RAVNOVESIYE I USTOYCHIVOST TOKOVOY PLAZMY V TOROIDALNYKH SISTEMAKH]
S. E. Rosinskii et al AEC 1969 25 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Moscow Preprint No. 51, NP-17973 Prepared for AEC
(AEC-tr-7123; NP-17973) Avail: CFSTI

Studies were made of toroidal plasma current instabilities caused by trapped and slow emitting particles. Criteria were established for stabilizing various modes of oscillations induced by radial electric fields, longitudinal particle current drifts, finite Larmor radii, finite drift orbits of trapped particles, and crossed lines of force in magnetic fields. It is shown that a certain channel type instability in trapped particles can be stabilized by expansion in the case in which the magnitude of rotational transformation has the wave length maximum lambda sub 11 along the magnetic field lines of force shorter than the distance between the local mirrors in the magnetic field (L). In the above case, the effective fraction of trapped particles with reduced lambda sub 11 decreased proportionally to (lambda sub 11/cu L). Toroidal current systems and stellarator systems are compared and analyzed. Author (NSA)

N70-27749# United Kingdom Atomic Energy Authority, Culham (England). Translations Office.
PLASMA THERMAL ISOLATION AND CONTAINMENT IN THE 'SIRUS' STELLARATOR
P. Ya. Burchenko et al Oct. 1969 9 p refs Transl. into ENGLISH from Kharkov Rept. FIAN-69-47
(CTO/672; FIAN-69-47) Avail: AEC Depository Libraries

An account is given of the results obtained from investigations of the energy and particle containment in an ohmically heated plasma carried out in SIRIUS with the object of throwing some light on the processes mainly responsible for the anomalously high transport coefficients in closed traps. NSA

N70-27803# Florida Univ., Gainesville. Div. of Nuclear Energineering Sciences.
ON ANNIHILATION AND OTHER INTERACTIONS OF POSITRONS IN A PLASMA, PART 2 Final Technical Report
Wilhelm G. Wolfer and Richard T. Schneider 1 Jan. 1970 140 p refs
(Contract Nonr-580(19))
(AD-702406) Avail: CFSTI CSCL 20/9

A consistent derivation of the nonrelativistic Hamiltonian for a many-body electron-positron system is given as well as a general formula for the annihilation probability in such a system. The derivations begin with the proper relativistic expressions and are based on a power expansion of the electron-positron field operators in terms of (k/K), where hk is the nonrelativistic momentum of the particles and K the inverse of the electron Compton wavelength. The theory is carried out up to the second power in (k/K) for the Hamiltonian as well as the annihilation probability. An upper momentum cut-off k(max) = K is introduced to avoid divergences and insure the convergence of the expansion. The annihilation rate and the angular correlation function are then evaluated for a plasma as a function of the electron temperature, assuming thermal equilibrium for electrons as well as positrons. Finally, a short survey of other processes than annihilation with free electrons is given. Author (TAB)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N70-26525 Polytechnic Inst. of Brooklyn, N.Y.
THE PRESSURE DEPENDENCE OF MAGNETIC PHASE TRANSITIONS
Gaetano T. Alfieri (Ph.D. Thesis) 1969 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-20313

In continuing magnetic studies of the rare-earth compounds with the CsCl structure, the RZn compounds (R = Ce, Pr, Nd, Sm Gd, Tb, Dy, Ho, Er) were prepared. Magnetization measurements showed that the heavy rare-earth compounds (Gd to Er) are ferromagnetic and the light rare-earth compounds, except SmZn, are paramagnetic and probably also antiferromagnetic. Investigation of the effect of high pressures on the strength of the magnetic exchange interactions in ferromagnetic rare-earth compounds of zinc with the CsCl structure was performed in a girdle apparatus by a transformer method. The Curie point was detected by a change in the secondary voltage. The results appeared to confirm the notion that the dependence of the exchange interaction on interatomic distance followed a Heisenberg type curve, with a maximum in the region of TbZn. Dissert. Abstr.

N70-26531 Michigan State Univ., East Lansing.
A STUDY OF VACANCIES IN TUNGSTEN QUENCHED IN SUPERFLUID HELIUM
Ronald Joseph Gripshover (Ph.D. Thesis) 1969 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-20866

A system has been constructed which permits the refractory body-centered-cubic metals to be annealed and quenched in the ultrapure conditions which exist in and directly above superfluid helium. Studies were made on vacancies quenched into fine tungsten wires and the subsequent annealing away of this quenched-in resistance. To determine the effective vacancy formation energy, tungsten specimens are quenched from temperatures between 1500 K and 3200 K. The quenched-in resistance varies somewhat from specimen to specimen, but the effective formation energy obtained for the fast quench data is nearly the same for all specimens and equal to 3.1 + or − 0.2 ev. This data establishes both the magnitude of the quenched-in resistance and the effective formation energy for fast quenched tungsten. Dissert. Abstr.

N70-26533 West Virginia Univ., Morgantown.
ELECTRON SPIN RESONANCE STUDIES OF SELECTED GAMMA IRRADIATED ORGANIC COMPOUNDS AND ELECTRON IRRADIATED SINGLE CRYSTALS OF ZINC OXIDE
James Marshall Smith (Ph.D. Thesis) 1969 149 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-20715

The interaction of radiation with matter by reporting results of the interaction of gamma radiation with some selected organic compounds and fast electrons with single crystals of zinc oxide (both pure and Li-doped) is presented. The paramagnetic entities resulting from these types of irradiation are studied with the aid of an electron spin resonance (ESR) spectrometer. The requirements of an ESR spectrometer are presented, and a report on the design, operation, and performance of a superheterodyne spectrometer constructed in an attempt to increase sensitivity for detecting paramagnetic constituents is submitted. The difficulties involved in tuning the spectrometer prevented its use routinely. An analysis of isotropic and anisotropic hyperfine splitting of Zeeman levels is presented to aid in the interpretation of ESR spectra of irradiated organic radicals. This analysis is applied in a review of organic free radicals produced directly or indirectly by the attachment of a hydrogen atom at a preferred site of a molecule. Dissert. Abstr.

N70-26535 Washington Univ., Seattle.
CROSS OVER RELAXATION IN POTASSIUM DIHYDROGEN ARSENATE
Wendland Beezhold (Ph.D. Thesis) 1969 136 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-20207

An extensive study of the crossover regions has been made. It is found that the observed crossover pattern can be reproduced with considerable precision by a calculation based on a model of the electric-field-gradient tensor at the arsenic site which is suggested by the crystal structure in the ordered state. The comparison with experimental data yields a value of the electric quadrupole coupling constant equal to 34.8 MHz at 77 K. Also determined are the orientation of the principal axes, the value of the asymmetry parameter and the temperature dependence of the electric quadrupole coupling constant. Details of the relaxation rate at and nearby crossover points have been studied using both continuous wave and pulsed NMR techniques. The absolute proton relaxation rates are explained in terms of dipolar coupling between protons and rapidly relaxing arsenic nuclei together with the assumption of strain broadening for the arsenic transitions. The experimentally measured relaxation rates are shown to be consistent with the theoretical predictions. Dissert. Abstr.

N70-26551 Polytechnic Inst. of Brooklyn, N.Y.
SIMULTANEOUS BORRMANN EFFECT
Robert Edward Feldman (Ph.D. Thesis) 1969 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-20331

This investigation was concerned primarily with anomalously high transmission of x-rays through perfect Ge and Si crystals when the sets of planes are simultaneously in diffracting positions. In an effort to understand the phenomenon involved and to lay the groundwork for subsequent calculations of intensities and polarizations of diffracted beams, the complete complex dispersion surfaces for simultaneous diffraction in Si and Ge were calculated for Cu K alpha radiation and for regions of reciprocal space adjacent to the diameter points. In addition, measurements of absorption of Cu K alpha under conditions of simultaneous diffraction were made and compared with calculations based on the dynamical theory. Also a comprehensive set of photographs illustrating the simultaneous diffraction effects was obtained. Dissert. Abstr.

N70-26555*# Research Triangle Inst., Durham, N.C.
THE DEVELOPMENT OF RADIATION RESISTANT INSULATING LAYERS FOR PLANAR SILICON TECHNOLOGY, 29 MAY 1968 – 28 JUNE 1969
R. P. Donovan, M. Simons, and L. K. Monteith (North Carolina State Univ.) Washington NASA May 1970 50 p refs
(Contract NAS1-8156)
(NASA-CR-1584) Avail: CFSTI CSCL 20L

Two methods were investigated for improving the radiation resistance of thermal oxides on silicon: ion implantation and evaporation of SiO. The more promising method is that in which the properties of the thermal oxide were modified by an ion implantation process. This method of radiation hardening retains the advantages of thermal oxidation techniques and requires only the degradation of a specific property; the electron lifetime in the oxide. Investigations were conducted on implantations which were sufficiently high in fluence to introduce a small shift into the initial C-V characteristic of the MOS capacitor structure used for evaluating the modification. The magnitude of the shift is small when compared to the improvement in radiation hardness and varies with fluence. Author

N70-26567*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SMALL BALLISTIC RANGE FOR IMPACT METAMORPHISM STUDIES
Friederich Hoerz Washington May 1970 17 p refs
(NASA-TN-D-5787; A-3181) Avail: CFSTI CSCL 20B

This paper describes the design and operation of a ballistic range capable of shock loading rocks and minerals to precisely known pressures. The projectile is accelerated by conventional gunpowder and launched in a 20-mm gun barrel. A system of He/Ne lasers and photodiodes in combination with three X-ray flash tubes permits accurate timing. X-ray shadow photographs are superimposed on a precise fiducial grid, which monitors possible projectile tilt. The maximum velocities obtained to date are 3.2 km/sec. The maximum pressures achievable in various geological materials range from 250–500 kb, depending on the respective densities of the target and the projectile. Cleavage in quartz is produced by shock pressures as low as 50 kb and develops predominantly on crystallographic planes with high resolved shear stress. Planar features develop at pressures above 100 kb and cluster near (1013) regardless of impact direction; at pressures above 160 kb, they develop strongly on (1012). Refractive index measurements indicate that the breakdown of the quartz lattice to an amorphous state occurs gradually over a pressure range from about 200 to 300 kb. Author

N70-26570 Polytechnic Inst. of Brooklyn, N.Y.
IONIC MIGRATION IN SILICON DIOXIDE AND TITANIUM DIOXIDE FILMS
Morton Schrager (Ph.D. Thesis) 1969 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-20364

The first part of the research was a theoretical development of the ionic migration behavior on the basis of the Poisson – Boltzmann equation extending an earlier treatment into the low applied potential region. The second part of the research was experimental and consisted in the extension of the capacitance-bias measurement technique to study ion migration in polycrystalline rutile (TiO2) films. A new MOOS device of the form metal electrode TiO2 SiO2 Si was constructed to accomplish ion migration measurements. Ion migration in rutile films was monitored through the use of temperature bias experiments, followed by capacitance vs. DC bias (C-V) measurements. Total charge transfer was also measured in depolarization experiments. For the first time, ion migration was observed in rutile films. Field induced ion migration appears to be activated at considerably lower temperatures in rutile as compared with SiO2. Dissert. Abstr.

N70-26573 Polytechnic Inst. of Brooklyn, N.Y.
ELECTRIC FIELD EFFECTS ON THE FUNDAMENTAL ABSORPTION BAND OF POTASSIUM IODIDE
Michael Thomas Stevens (Ph.D. Thesis) 1969 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-20373

An experiment was performed to measure the effect of an electric field on the fundamental absorption band of potassium iodide in the spectral region from 5.5 to 7.3 ev. Findings indicate that the Stark effect of the lowest energy exciton is quadratic in the electric field over the range investigated, from 50,000 v/cm to 2 million v/cm, peak. The polarizability of this exciton state was used to obtain an estimate of its spatial extent. It was found that the rms radius of this exciton is 7.4 A, which is of the same order of magnitude as the lattice constant 7.03 A. Although the absorption in this region is quite intense, the effect of an electric field on the states causing this absorption is relatively small. The lack of an observable Stark effect of magnitude comparable to that of the 5.8 ev exciton, however, leads to the conclusion that the spin-orbit mate is probably not one of the main absorption peaks, but in all likelihood is one of the smaller peaks resolved only at very low temperatures. Dissert. Abstr.

N70-26591 Pennsylvania Univ., Philadelphia.
THE MAGNETIC IMPURITY PROBLEM: A STUDY OF THE MAGNETIC PROPERTIES OF Fe IN Cu AND ALPHA-PHASE CuAl ALLOYS
David Clarence Golibersuch (Ph.D. Thesis) 1969 189 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-21358

In an attempt to verify the existence of the extended spin polarization cloud associated with the ground state of the magnetic impurity problem a thorough study of the magnetic properties of the CuFe system was made. The data implies the existence of spatially extended spin correlations which build up continuously with decreasing temperature for T << T sub K. Comparing published bulk susceptibility and Mossbauer data approximately one half of the total zero temperature susceptibility resides locally on the impurity site, the remainder being distributed in a spatially extended polarization cloud around the impurity. Study of the nuclear resonance line-widths of the host nuclei between T = 1 K and T = 300 K is made. Analysis of this resonance data provides a measure of the temperature dependence of the amplitude of the spin polarization cloud. Dissert. Abstr.

N70-26592 California Inst. of Tech., Pasadena.
OPTICAL AND ELECTRICAL PROPERTIES OF ALPHA-MONOCLINIC SELENIUM
John Millard Caywood (Ph.D. Thesis) 1969 70 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-19595

The optical absorption of alpha-monoclinic selenium was measured over the range in wavelength 1.15 micron to 0.2775 micron. The data show a well defined absorption edge at 2.25 eV with further structure appearing as changes in d alpha/dE at 2.85 eV and 3.75 eV. For comparison the absorption of selenium in solutions in which it is believed to exist in the same eight-membered puckered ring as in the crystal was measured. This absorption is qualitatively different from that of the crystal. The existence of surface barriers on alpha-monoclinic selenium crystals was demonstrated. Photometric measurements indicate electron barrier heights of 1.05 eV and 1.3 eV, respectively, for Ga and Au contacts. The mobilities of holes and electrons were measured at room temperature. The hole mobility was found to be limited by traps 0.23 + or – .01 eV above the valence levels, while the electron mobility is an intrinsic mobility limited only by scattering. Dissert. Abstr.

N70-26594 Johns Hopkins Univ., Baltimore, Md.
LIGHT SCATTERING STUDIES OF THE ALPHA-BETA PHASE TRANSITION IN QUARTZ
Stephen Michael Shapiro (Ph.D. Thesis) 1969 210 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 69-21061

On the basis of early theoretical and experimental investigations of the alpha-beta phase transition in crystalline quartz, it has been accepted that the transition is second order, the quartz crystal exhibits critical opalescence at the transition temperature, and the 207 inverse cm Raman active, zone center optic vibration is the soft mode responsible for the phase transition. The Raman and Brillouin spectra of crystalline quartz from 20 K to 873 K (600 C) are studied with special attention devoted to the alpha-beta transition region. The temperature hysteresis observed in the Raman and Brillouin experiments suggests that quartz undergoes a first order transition rather than a second order transition. Observations of the Rayleigh scattered light at the transition temperature showed that the large increase in the elastic scattering is due to essentially static inhomogeneities in the index of refraction. Two possible sources of the inhomogeneities are domain boundaries between the two members of the Dauphine twins coexisting in the quartz crystal, or the formation, on heating, of beta quartz regions within the alpha quartz crystal. Dissert. Abstr.

N70-26601 Polytechnic Inst. of Brooklyn, N.Y.
ANISOTROPIC SECONDARY EMISSION AND OTHER DYNAMICAL EFFECT IN LOW ENERGY ELECTRON DIFFRACTION
Howard Hyman Taub (Ph.D. Thesis) 1969 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-20378

It is observed that the total secondary electron emission from single crystals depends on the incident direction of the primary electron beam. A dynamical diffraction model is proposed to explain these effects; it is also applied to several other dynamical effects observed using the techniques of low energy electron diffraction. The introduction of a convenient geometric representation of the important diffraction conditions (the Brillouin zone diagram) and use of the reciprocity theorem predicts not only the existence of maxima in emission when the incident beam corresponds to low-index directions in the crystal but also predicts the angular widths of these peaks, conditions under which the peaks may vanish, and the existence of maxima not corresponding to low-index directions. Based on the agreement between the angular positions of the dips in emission and orientations of the incident beam which correspond to zone boundaries, it is concluded that the maxima in emission are artifacts resulting from negative contributions to the secondary emission due to forward diffraction. Dissert. Abstr.

N70-26720# California Univ., San Diego. Dept. of Physics.
THEORY OF METAL SURFACES: CHARGE DENSITY AND SURFACE ENERGY
N. D. Lang and W. Kohn [1969] 49 p refs Sponsored by ONR and NSF
Avail: Issuing Activity

The first part of this paper deals with the jellium model of a metal surface. The theory of the inhomogeneous electron gas, with local exchange and correlation energies, is used. Self-consistent electron density distributions are obtained. The surface energy is found to be negative for high densities. In the second part, two corrections to the surface energy are calculated which arise when the positive background model is replaced by a pseudopotential model of the ions. One correction is a cleavage energy of a classical neutralized lattice, the other an interaction energy of the pseudopotentials with the electrons. Both of these corrections are essential at higher densities. The resulting surface energy is in semiquantitative agreement with surface-tension measurements for eight simple metals (Li, Na, K, Rb, Cs, Mg, Zn, Al), typical errors being about 25%. For Pb there is a serious disagreement. Author

N70-26730# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
DENSE RANDOM PACKING OF HARD SPHERES AS A STRUCTURAL MODEL FOR NON-CRYSTALLINE METALLIC SOLIDS Technical Report
G. S. Cargill, III Nov. 1969 14 p refs
(Contract N00014-67-A-0298-0009)
(AD-700709; TR-25) Avail: CFSTI CSCL 20/2

The pair distribution function for dense random packing of hard spheres is very similar to that observed for non-crystalline Ni-P alloys. The hard sphere model distribution function has a split second peak; this splitting is a characteristic structural feature of most non-crystalline metallic alloys. The positions of the maxima in the hard sphere distribution function agree with those observed for noncrystalline Ni-P alloys when 2.42 A is taken for the hard sphere diameter in the Ni-P structure. The dense random packing of hard spheres also appears to be a promising structural model for other non-crystalline metallic solids. Author (TAB)

N70-26825# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
SOLID-STATE AND MOLECULAR THEORY GROUP Semiannual Progress Report
15 Jan. 1970 106 p refs
(Contracts F44620-69-C-0054; ARPA SD-90; Grant NSF GP-7677)
(AD-700898; SAPR-72) Avail: CFSTI CSCL 20/12

The paper reports studies on the following topics: the Compton scattering of x-rays from solids, methods for studying molecular electronic structure, energy band calculations, lattices of interacting spins, and the theory of continuous groups and their representations and in particular the application of this theory to the hydrogen atom. TAB

N70-26828# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PREPARATION OF CU 2S FILM SINGLE CRYSTALS
Z. A. Aliyarova et al 18 Sep. 1969 7 p refs Transl. into ENGLISH from the Russian
(AD-700372; FTD-HT-23-369-69) Avail: CFSTI CSCL 20/2

The compound Cu2S was synthesized by melting components in a stoichiometric ratio. Electronographic and X-ray diffraction analysis show that the obtained compound is a low-temperature modification of Cu2S with a rhombic lattice. The compound has p-type conductivity. The concentration of free carriers comprises 8.5 x 10 to the -19th cu cm, the resistivity is 0.07 ohm.cm, and the thermal emf is 86 micron V/deg. Polycrystal and single-crystal films 250 A thick were obtained from this substance by the epitaxial method. Author (TAB)

N70-26836# Rensselaer Polytechnic Inst., Troy, N.Y. Div. of Materials Engineering.
SEMI-CONDUCTION AND ELECTRON HOPPING IN VITREOUS SYSTEMS: MICRO-STRUCTURE AND MAGNETIC PROPERTIES
Robert K. Mac Crone Jan. 1970 22 p refs
(Contract N00014-67-A-0117-0008)
(AD-700750; RPI-404.09-TR-1) Avail: CFSTI CSCL 20/12

The experimental techniques used in this program are given and some problems discussed. The dependence of magnetization on microstructure has been investigated in a B2O3 -BaO - Fe2O3 glass, and the results correlated with small angle X-ray scattering data. In addition, the microstructure has been found to depend strongly on Fe2O3 concentration. Based on these results, specific key research areas have been identified. Author (TAB)

N70-26839# Naval Research Lab., Washington, D.C.
PROCEEDINGS OF THE 3RD SYMPOSIUM. THE 1969 SPRING SUPERCONDUCTING SYMPOSIA
Robert A. Hein, ed. 16 May 1969 64 p refs Sponsored in part by ONR
(AD-700656; NRL-6986) Avail: CFSTI CSCL 20/3

Contents: Electron tunneling investigations in amorphous and disordered superconductors; Enhancement of Tc in thin films; Molecular enhancement effects; and Theories of enhancement effects. TAB

N70-26872# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFRARED ABSORPTION IN CD SB, ALLOYED WITH INDIUM
A. N. Borets et al 3 Oct. 1969 8 p refs Transl. into ENGLISH from Ser. Fiz.-Mat. i Istoricheskikh Nauk (USSR), 1965 p 68-72
(AD-700367; FTD-MT-24-232-69) Avail: CFSTI CSCL 20/12

The optical properties, infrared absorption, and reflection of CdSb monocrystals alloyed with various amounts of In were studied in an investigation extending an earlier work of one of the present authors on the semiconductor properties of CdSb crystals alloyed with various elements. The form of the absorption and reflection spectra depended on the initial composition of the specimen and on the temperature. It is believed that the observed infrared spectral dependence of CdSb(In) crystals is due to the formation of a donor level at a depth of 0.09 eV below the conduction band. Author (TAB)

N70-26880# Massachusetts Univ., Amherst. Dept. of Physics and Astronomy.
VACANCY INTERSTITIAL PAIRS IN QUANTUM CRYSTALS
William J. Mullin 2 Mar. 1970 11 p refs
(Contract N00014-67-A-0230-0003)
(AD-701793) Avail: CFSTI CSCL 20/12

A cell model Hamiltonian which describes particles on lattice sites with possible tunneling to surrounding interstitial sites is used to describe quantum crystal phenomena including Frenkel vacancy-interstitial pairs in the ground state, pair wave and Schottky vacancy wave excited states, exchange, and the transition to the superfluid state. Author (TAB)

N70-26901# Joint Publications Research Service, Washington, D.C.
SELECTION AND DISSEMINATION OF INFORMATION

13 Feb. 1970 15 p refs Transl. into ENGLISH from Otbor i Peredacha Inform. (Kiev), no. 20, 1969 p 23–32
(JPRS-49839) Avail: CFSTI

CONTENTS:

1. ON THE EFFECTS OF ELECTRICAL PARAMETERS OF SEMICONDUCTOR MEDIA ON DAMPING OF TM-WAVE'S SURFACES V. I. Gordiyenko p 1–3 refs (See N70-26902 13-26)

2. SURFACE TE-WAVE IN MULTILAYERED SYSTEMS V. I. Gordiyenko p 4–13 refs (See N70-26903 13-26)

N70-26902# Joint Publications Research Service, Washington, D.C.

ON THE EFFECT OF ELECTRICAL PARAMETERS OF SEMICONDUCTOR MEDIA ON DAMPING OF TM-WAVE'S SURFACES

V. I. Gordiyenko *In its* Selection and Dissemination of Inform. 13 Feb. 1970 p 1–3 refs (See N70-26901 13-26)
Avail: CFSTI

The effects on TM wave damping of the specific conductivity and dielectric permeability of clay, wet soil, and dry soil were determined and compared to the effects of air. A steel wire was used for the information transmission. The damping was least with the wire in air and most with it in clay. It was found that with a source excitation frequency less than 10 kcps transmission is possible in clay, while in the wet and dry soils transmission is possible over a large range of frequencies. N.E.N.

N70-26903# Joint Publications Research Service, Washington, D.C.

SURFACE TE-WAVE IN MULTILAYERED SYSTEMS

V. I. Gordiyenko In its Selection and Dissemination of Inform. 13 Feb. 1970 p 4–13 refs (See N70-26901 13-26)
Avail: CFSTI

Mathematical models of the TE-wave damping in two- and three-layered media are discussed. Equations are derived for the propagation constant in a three-layered system up to 10 kcps. This was found to be equal to the propagation constant in a two-layered system, multiplied by the ratio of the radii of the directing surfaces. N.E.N.

N70-26958# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

BINDING ENERGY OF THE SYSTEM COMPOSED OF AN EXCITON AND AN ELECTRON TRAPPED BY AN IMPURITY CENTER IN A SEMICONDUCTOR [ENERGIE DE LIAISON DU SYSTEME COMPOSE D'UN EXCITON ET D'UN ELECTRON PIEGES PAR UN CENTRE D'IMPURITE DANS UN SEMI-CONDUCTEUR]

G. Munschy Feb. 1970 23 p refs Transl. into ENGLISH from J. Phys. (Paris), v. 28, Mar.-Apr. 1968 p 307–314 Prepared for Lincoln Lab., MIT
(AZT-70-201-FRLL) Avail: CFSTI

The complex consisting of an exciton and an electron trapped by an impurity center fixed in the crystal lattice of a semiconductor is studied in the effective mass approximation. Its binding energy is given as a function of the ratio of hole-to-electron effective masses by means of quantum mechanical variational calculations. Author

N70-27016# Radio Corp. of America, Princeton, N.J.

SEMICONDUCTING FERROMAGNETIC MATERIALS Final Report, 16 Dec. 1966–15 Dec. 1969

Peter J. Wojtowicz, Stuart B. Berger, and Harry L. Pinch 15 Jan. 1970 47 p refs
(Contract F19628-67-C-0175)
(AD-701409; AFCRL-70-0045) Avail: CFSTI CSCL 20/12

The research described in this report had two principal long-range goals. The effort was directed toward gaining a sufficient background of knowledge which would lead to increases in the Curie temperatures and in the mobilities of the chromium chalcogenide spinel type of ferromagnetic semiconductors. The first goal was pursued through attempts to understand the nature of the magnetic exchange interactions and through the synthesis of many more compounds of the chalcogenide spinel type. Increases in the mobility were sought through first understanding the nature of the defects and nonstoichiometry in chromium containing chalcogenide material. Nonstoichiometry has been shown to be a significant factor in the determination of the magnetic and electrical properties of the chromium chalcogenide spinels. The nature of the exchange interactions in chromium containing chalcogenide spinels was examined in some detail. The exchange interactions of the chromium chalcogenide spinels, furthermore, have been related to the hyperfine parameters of nuclear magnetic resonance. A large number of new materials were synthesized in attempts to find semiconducting ferromagnetic compounds with Curie points higher than CdCr2Se4 (130 degrees K). TAB

N70-27087# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.

GASEOUS AND SOLID STATE PLASMA DEVICE STUDIES Final Scientific Report, 1 Jul. 1968–30 Jun. 1969

Bertil Agdur 31 Jul. 1969 111 p refs
(Contract F61052-69-C-0001)
(AD-701751; RADC-TR-69-449) Avail: CFSTI CSCL 20/12

The subjects which have been treated are: Switching phenomena and high frequency instabilities in avalanching indium-antimonide; Low-field noise emission from indium-antimonide in a magnetic field; Slow-wave amplification in semiconductors with current saturation; and High-field phenomena in semiconductors in a strong longitudinal magnetic field. TAB

N70-27088# Boston Univ., Mass. Dept. of Physics.

COMPUTATIONAL TECHNIQUES IN SINGLE CRYSTAL MOESSBAUER SPECTHOSCOPY Scientific Report

Kawchan P. Singh and Gilbert R. Hoy 24 Nov. 1969 55 p refs
(Contract F19628-69-C-0002)
(AD-701766; AFCRL-70-0010; SR-1) Avail: CFSTI CSCL 20/2

The report summarizes some computational techniques which can be used to extract the effective field parameters from a given single crystal Mossbauer spectrum. The effective field parameters in this case are the effective electric field gradient and magnetic field at the locations of Fe57 nuclei. In order to accomplish this, numerical calculations must be made to find the eigenvalues and eigenvectors of the nuclear interaction Hamiltonian. There are two possible convenient choices for the quantization axis. They are: the major axis of the electric field gradient tensor in its principal axis system, or the magnetic field direction. Procedures for both choices are included. In addition to the values of the effective fields, it is also possible to determine the orientation of the principal axis system of the electric field gradient tensor with respect to the crystalline axes. This provides information about the electronic structure of the iron ion in the solid. The results can be used for both single and polycrystalline samples. Furthermore, the procedures include the possibility of an external magnetic field being applied to the crystal under study. Author (TAB)

N70-27184*# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Physics.

ELECTRON AND FIELD INTERACTIONS WITH THIN FILMS AND SURFACES Final Report

H. J. Juretschke 1 Apr. 1970 7 p refs
(Grant NGR-33-006-007)
(NASA-CR-109825) Avail: CFSTI CSCL 20L

Results of a study are presented dealing with various aspects of the interactions of surfaces with electrons or X-rays. The problems investigated are described along with the results obtained and include the following: (1) The collisions of electrons with boundary surfaces were studied to determine how these special collisions affect the electrical transport properties in thin samples. (2) An experimental and theoretical program was developed to study the electric field effect in metals and the interaction of electrons and adsorbed gases with metallic surfaces. (3) A combination of measurements were carried out involving resonance absorption in microwave fields, to show that a determination of spin wave boundary conditions of the longest spin wave modes is possible. (4) X-rays, representing electromagnetic waves comparable to those of metallic electrons, were studied to determine the coupling of waves to surfaces and thin films. (5) Two specific theories of low energy electron diffraction were developed; one emphasizing the most direct way of obtaining diffraction intensities, the other stressing the physical understanding of the strong coupling accompanying electron scattering. D.L.G.

N70-27215# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
EXPERIMENTAL PHONON PHYSICS Progress Report, 1 Apr. 1969–31 Mar. 1970
R. O. Pohl, J. A. Krumhansl, and A. J. Sievers [1970] 20 p refs
(Contract AT(30-1)-2391)
(NYO-2391-108) Avail: CFSTI

Progress is reported on research on: (1) second sound in solids; (2) cooperative phenomena in dilute dipolar systems; (3) specific heat anomaly in crystals containing low frequency resonance states; (4) generation of microwave frequency phonons using impurity modes of the tunneling type; (5) heat pulses; (6) heat transport in magnetic insulators; (7) far infrared properties of impurity modes; (8) infrared properties of a composite structure; (9) far infrared properties of metals; and (10) far infrared instrumentation. Author

N70-27267 Duke Univ., Durham, N.C.
THEORY OF QUANTUM CRYSTALS
Berge Sarkissian (Ph.D. Thesis) 1969 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-22072

Due to its small mass and weak (Van der Waal) interatomic forces solid helium has a large zero-point motion. The rms displacement is about 30% of the interparticle distance. Classical theories based on small oscillations of atoms from their equilibrium sites and which are quite adequate in the description of the dynamics of most all other dielectric solids fail in this case, thus the name 'Quantum Crystal.' Ordinary perturbation theories also fail because of this large zero-point motion and also because of divergences due to the infinite hard core in the interatomic potential at close distances. A one-sided cluster expansion of the energy, which is shown to be equivalent to an infinite order perturbation theory in the Pair approximation, is made and a self-consistent set of equations are derived which describe the localization of a particle in the effective potential well due to all its neighbors. The equations are similar to those of Hartree but with the added advantage of using exact two-particle wavefunctions very similar to a T-matrix calculation. A short range dynamic correlation function is introduced to describe a part of the two-particle wavefunction and is solved through an eigenvalue problem rather than variationally. The ground-state energy, pressure, compressibility and spring constants (rms displacements) are calculated numerically as a function of molar volume and are found to be in good agreement with experiments. Dissert. Abstr.

N70-27281*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERACTION OF METHANE, ETHANE, ETHYLENE, AND ACETYLENE WITH AN IRON (001) SURFACE AND THEIR INFLUENCE ON ADHESION STUDIED WITH LEED AND AUGER
Donald H. Buckley Washington May 1970 25 p refs
(NASA-TN-D-5822) Avail: CFSTI CSCL 07D

Adhesion studies were conducted with iron (001) surfaces in the presence of various adsorbed hydrocarbons: methane, ethane, ethylene, and acetylene. Data indicate that an increase in the number of carbon atoms from 1 to 2 results in a decrease in adhesive forces between metal surfaces. The greater the degree of bond unsaturation, the lower the adhesive force for equivalent surface coverages. All the hydrocarbons adsorbed to clean iron at 20 C, indicating additional activation energy is not required for chemisorption of hydrocarbons to iron. Oxygen and sulfur were found to displace ethylene and acetylene films from an iron surface. Author

N70-27303# Saarland Univ., Saarbrucken (West Germany). Inst. fuer Experimentalphysik 2.
FERROELECTRICITY IN ROCHELLE SALT [ZUR FERROELEKTRIZITAET IN SEIGNETTESALZ]
Juergen Pottharst (Ph.D. Thesis) 1969 72 p refs In GERMAN
Avail: CFSTI

In Rochelle salt, a dielectric dispersion may be observed in the higher frequency range. This dispersion is described by a Debye relaxation equation with a discrete time constant. Crystal water vacancies lead to a distribution of time constants, while the monodispersive character is not altered by foreign Rb atoms. The dispersion of deuterium loaded Rochelle salt has practically the same characteristics as normal Rochelle salt, although a noticeable Curie-point shift takes place. The dielectric modules may be described by a Curie-Weiss law. Author (ESRO)

N70-27306# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
MEASUREMENT OF SURFACE POTENTIALS AND DETERMINATION OF FREE ENTHALPIES OF FORMATION OF FRENKEL DEFECTS IN Ag Br [MESURE DU POTENTIEL DE SURFACE ET DETERMINATION DES ENTHALPIES LIBRES DE FORMATION DES DEFAUTS DE FRENKEL DANS Ag Br]
Jean-Louis Crolet Mar. 1970 44 p refs In FRENCH; ENGLISH summary
(CEA-R-3972) Avail: CFSTI

The problem of point defect equilibria near the surface of ionic crystals is re-examined from the viewpoint of statistical mechanics and the influence of the environment on that equilibria is emphasized. A theoretical model is developed and the superficial capacity measurements are interpreted which allows the surface potential and the free enthalpies of formation of defects to be determined. For silver bromide in equilibrium with silver at 292 C, these values are respectively – 0.21 V for the surface potential and 0.12 and 0.58 eV for the free enthalpies of formation of vacancies and interstitials. Author (ESRO)

N70-27309# North Carolina Univ., Chapel Hill. Dept. of Physics.
[SOLID STATE STUDIES] Progress Report, 16 Dec. 1968–15 Dec. 1969
Lawrence Slifkin and Anand Batra [1970] 6 p refs
(Contract AT(40-1)-2036)
(ORO-2036-12) Avail: CFSTI

Progress is reported on the effects of a vacancy flux and activity coefficient gradient on tracer diffusion in silver-gold alloys, on the diffusion of silver tracer into aluminum single crystals in a

magnetic field, on impurity ion diffusion in silver halides, and on the internal friction of vacancy formation and dislocation pinning in silver bromide. R.B.

N70-27322*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A GUIDE TO THE LITERATURE ON MERCURY CADMIUM TELLURIDE PHOTODETECTORS (1 JANUARY 1959–30 JUNE 1969)

John B. Mc Day, John H. Mc Elroy, Steven C. Cohen, and Steven C. Flagiello Dec. 1969 38 p refs

(NASA-TM-X-63902; X-524-69-547) Avail: CFSTI CSCL 20L

The results of a literature search on mercury cadmium telluride photodetectors through twenty-six scientific and technical journals, three conference proceedings, and the NASA Scientific and Technical Aerospace Reports (STAR) for the period 1 January 1959 through 30 June 1969 are presented. The results are presented in a chronological listing in which each item contains three sections: (1) a standard bibliographical listing, (2) an abstract of the paper or article, and (3) a comprehensive listing of keywords or phrases extracted from the publication. This listing is followed by an alphabetical listing of the authors with their publications referenced to the chronological reference number assigned in the previous listing. The third listing, consisting of 125 items, gives, in alphabetical order, the extracted keywords and phrases referenced to the articles by the chronological reference numbers. Author

N70-27367# Saarland Univ., Saarbruecken (West Germany). Inst. fuer Metallphysik und Metallkunde.

INVESTIGATIONS OF THE TEMPERATURE BEHAVIOR OF HALL CONSTANT AND ELECTRIC CONDUCTIVITY BETWEEN 80 AND 1000 DEG K OF THE MIXED CRYSTAL SERIES COPPER-PALLADIUM WITH IRREGULAR AND REGULAR ATOM DISTRIBUTION [UNTERSUCHUNGEN UEBER DAS TEMPERATURVERHALTEN VON HALLKONSTANTE UND ELEKTRISCHER LEITFAEHIGKEIT ZWISCHEN 80 UND 1000 DEG K AN DER MISCH-KRISTALLREIHE KUPFER-PALLADIUM MIT REGELLOSER UND GEORDNETER ATOMVERTEILLUNG]

Guenter Rennollet (Ph.D. Thesis) 1969 88 p refs In GERMAN Avail: CFSTI

A device was developed for measurement of the Hall voltage with the DC-steady field method between the boiling temperature of nitrogen and approximately 1000 deg K. The Hall constant and the electrical resistance of 17 copper-palladium alloys and pure copper and palladium were determined after different treatments, such as 50% cold rolling, hardening from 700 deg and heat treatment. ESRO

N70-27379*# Colorado State Univ., Fort Collins. Dept. of Physics.

GROWTH OF CRYSTALS OF THE TERNARY SULFIDES Final Technical Report

Dale R. Winder 31 Jan. 1970 9 p

(Grant NGR-06-002-074)

(NASA-CR-86380) Avail: CFSTI CSCL 20B

Several charges of proustite and pyrargyrite were prepared using various techniques. The final procedure for preparing charges was to react the elements of 6-nines purity at a temperature of the order of 200 C above the melting point of the compound desired. The vessels were cleaned and prepared in a standard way, the charge loaded in, the vessel pumped and heated to drive off any water vapor, and sealed under a partial atmosphere of argon. The sealed capsule was heated in an auxiliary furnace in a protective metal tube. Attempts to row sulfur crystals by precipitation from carbon disulfide yielded only a few small crystals imbedded in a polycrystalline matrix. Author

N70-27394# Rochester Univ., N.Y.

ORIENTED BASIC RESEARCH IN THE PHYSICAL SCIENCES Final Report, 1 Aug. 1964–31 Jul. 1967

Kenneth J. Teegarden Feb. 1970 5 p refs

(Contract DA-31-124-ARO(D)-252)

(AD-701104; AROD-2045-11-P) Avail: CFSTI CSCL 20/12

The optical absorption of both pure alkali halides and alloys of RbCl-RbI, KCl-KI was measured at temperatures low enough to reveal previously unobserved structure in excitonic absorption lines. Studies of intrinsic luminescence have revealed new emission bands probably related to trapped exciton states, and have demonstrated the importance of host sensitized luminescence in the alkali halides. Two photon absorption measurements were attempted in KCl:Ag and NaCl:Ag. The two photon absorption spectrum of ZnS and CdS was measured over a two photon energy range of 2.5eV to 4.2eV. TAB

N70-27396# Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.

BIBLIOGRAPHY OF III-V SEMICONDUCTING FILMS

M. Neuberger Dec. 1969 101 p refs

(Contract F33615-68-C-1225)

(AD-701074; S-13) Avail: CFSTI CSCL 20/12

A bibliography of the properties and device applications of III-V semiconducting thin films is presented. The group III elements are aluminum, boron, gallium and indium. The properties included are electrical, magnetic, optical, photoelectronic and energy band structure. Author (TAB)

N70-27431*# Tufts Univ., Boston, Mass. Dept. of Electrical Engineering.

HIGH ELECTRIC FIELD EFFECTS IN WIDE GAP SEMICONDUCTORS Semiannual Status Report

Ronald B. Goldner Apr. 1970 9 p

(Grant NGR-22-012-020)

(NASA-CR-86381) Avail: CFSTI CSCL 20L

The progress during this period is reported. Included is the preparation of ZnSe crystals; electrodes of alloyed indium, and evaporated gold; and probes for determining the electric field distribution. Photo-Hall investigations and time of flight mobility versus electric field measurements are discussed. F.O.S.

N70-27433# Cornell Univ., Ithaca, N.Y. Materials Science Center.

FAR-INFRARED FREQUENCY DEPENDENCE OF THE ROOM TEMPERATURE SURFACE RESISTANCE OF LEAD

Richard Dixon Gillis Jan. 1970 41 p refs

(Contract AT(30-1)-2391)

(NYO-2391-107; Rept-1281) Avail: CFSTI

The transmission line method, which allows the sample to be removed from the detector, was used to study the optical constants of lead in the far infrared region. The radiation is directed between a series of parallel metal plates separated by a given amount, and the resultant intensity of the radiation is measured. The construction of such a transmission line and the measuring of lead in the far infrared at room temperature was investigated. The experimental results are compared with the Drude theory and a correlation is proposed. S.S.

N70-27549# Signals Research and Development Establishment, Christchurch (England).

SOME EXPERIMENTS ON Er (3+) DOPED LITHIUM YTTRIUM TETRAFLUORIDE

M. R. Brown, K. J. Roots, and W. A. Shand Jul. 1969 37 p refs

(SRDE-69027) Avail: CFSTI

The previous work on the infrared quantum counter action in Er(3+) doped SrF2 (SRDE 66009) showed that it was possible

to increase the efficiency of the action by codoping with a second rare earth ion. This report covers the work done on the Ker(3+) doped LiYF4 and Er(3+) : Yb(3+) doped LiYF4 system to evaluate the energy levels of the Er(3+) in a site that does not require charge compensation and the increase of efficiency that comes with codoping with Yb(3+). The results show that the positions of the energy levels are substantially unchanged in moving from one lattice to another and an increase in efficiency of the action, of the order, forty times can be achieved with a composition in the region of 2% Er(3+) : 18% Yb(3+) doped LiYF4. Author (ESRO)

N70-27608# Gosudarstvennyi Komitet po Ispolzovani Yu Atomnoi Energii, Moscow (USSR). Inst. Atomnoi Energii.
CONCERNING THE EFFECT OF THE NEUTRON SPECTRUM DURING IRRADIATION OF CRYSTALS [O VLIYANII SPEKTRA NEITRONOV PRI OBLUCHENII KRISTALLOV]
N. A. Ukhin and A. V. Krustalev 1969 47 p refs In RUSSIAN; ENGLISH summary
(IAE-1880) Avail: AEC Depository Libraries

Calculation was carried out for the damage function in silicon, indicating the mean value of the secondary displacements due to the neutron interaction with the lattice atoms. This function was compared with similar functions calculated earlier by other authors. It is shown that the anisotropy of the neutron elastic dispersion and the high-energy neutron inelastic dispersion must be taken into account. Different damage functions took into consideration possible ways of including the neutron spectra in the radiation effects in silicon. It is shown that there is a threshold energy at which there was a small spectral dependence of the radiation damage. The value of the optimum threshold energy depends on the shape of the damage function. Using the damage function calculated for silicon, the value of the optimum threshold energy was 0.4 MeV. Author (NSA)

N70-27612# Brown Univ., Providence, R.I. Metals Research Lab.
[ORIGIN AND PROPERTIES OF CRYSTAL DEFECTS] Final Report
C. Elbaum Jan. 1970 9 p refs
(Contract Nonr-562(27))
(AD-701694) Avail: CFSTI CSCL 20/12

A number of experimental and theoretical projects were carried out; for example, it was demonstrated that condensation of vacancies constitutes an important mechanism for forming dislocations following crystal growth. The electric charge associated with dislocations in ionic crystals was determined directly for the first time; It was shown theoretically that electronic energy bands are associated with dislocations in wide-band-gap compound semiconductors and certain characteristics of these bands were predicted; In a study of the drag on moving dislocations in metals it was demonstrated that the interaction due to conduction electrons is temperature independent and is dominant only at very low temperatures. Further investigations of these problems are in progress. TAB

N70-27636# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
DEFECT INTERACTIONS AND RELAXATION PHENOMENA ASSOCIATED WITH ELECTRONIC MOTION IN SEMICONDUCTING CERAMICS Final Report, 1 Jun. 1965–30 Apr. 1969
C. Bauer, J. J. Stiglich, Jr., and D. H. Whitmore Wright-Patterson AFB, Ohio ARL Dec. 1969 205 p refs
(Contract AF 33(615)-2610).
(AD-701767; ARL-69-0211) Avail: CFSTI CSCL 20/12

Studies of the defect structures and mass transport in alkali halides and nonstoichiometric compounds are reported. Some regular solution statistical mechanical treatments were used to quantitatively predict the pairwise interaction energies between nearest-neighbor point defects in metal-excess, nonstoichiometric compounds. The ionic conductivity of pure and doped NaF was measured over a wide range of temperature and these results were analyzed by a nonlinear least-square method to yield the usual defect parameters. Interdiffusion and defect structure measurements on NiO + CoO solid solutions were carried out at elevated temperatures with the aid of appropriate x-ray methods. The diffusion observations are rationalized on the basis of the equilibrium defect structure inferred from integrated x-ray intensity data on these oxide solid solutions. Author (TAB)

N70-27714# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
SPECTRA AND ZEEMAN EFFECTS OF RUBY SINGLE CRYSTALS AT LOW TEMPERATURES
Stephen F. Jacobs Jan. 1969 78 p refs *Its* Spectroscopic Rept. No. 24
(Contract AT(30-1)-1447)
(NYO-1447-57) Avail: CFSTI

The fluorescence and absorption spectra of single ruby crystals have been obtained with high dispersion at temperatures from 4.2 deg to 300 K in the region 2500 to 27000 A. Zeeman splitting of the sharp lines has been measured at 4.2 deg and 77 K for fields up to 35 kG and for various crystal orientations. In addition to the sharp line absorption near 6900 and 4700 A, four strong sharp lines are observed in the ultraviolet. Asymmetric splitting of the ground level is measured and is found to depend on crystal orientation in the field. A level 20.35/cm above the ground level is found that exhibits magnetic behavior similar to that of the ground level. There is evidence of two other low-lying levels 143 and 376.8/cm above the ground level. The latter is identified as a Raman vibration of alumina. A partial energy level diagram is presented. Author

N70-27723# Carnegie-Mellon Univ., Pittsburgh, Pa.
SPECIFIC HEAT OF n- AND p-TYPE Bi2Te3 FROM 1.4 TO 90 K
Gary E. Shoemake, John A. Rayne, and Roland W. Ure, Jr. (Westinghouse Res. Labs.) 4 Mar. 1969 14 p refs
(Grants AF-AFOSR-870-65; AF-AFOSR-69-1765)
(AD-701287) Avail: CFSTI CSCL 20/12

The specific heats of n-type bismuth telluride, and bismuth selenide have been measured from 1.3 to 90K. At low temperatures, there are measurable differences in the electronic specific heat of n-type Bi2Te3 as a function of carrier concentration. These differences can be explained on the basis of a conduction band consisting of six ellipsoidal minima and an additional heavy-mass band lying approximately 30 meV above them. The electronic specific heat of p-type Bi2Te3 is consistent with a six-ellipsoid model. For both n- and p-type Bi2Te3, as well as Bi2Se3, departure of the lattice specific heat from the Debye T cubed approximation begins well below the lowest temperatures measured. The extrapolated Debye temperature at absolute zero is (162)K for Bi2Te3, which agrees well with the value of (165)K obtained from the low-temperature elastic constants. Bi2Se3 has been found to have a limiting Debye temperature of (182)K. Author (TAB)

N70-27738# Commissariat a l'Energie Atomique, Bruyeres-Le-Chatel (France). Centre d'Etudes.
PHASE DIAGRAM OF BISMUTH UNDER HIGH PRESSURE AND LOW TEMPERATURE [DIAGRAMME DE PHASES DU BISMUTH SOUS HAUTES PRESSIONS A BASSE TEMPERATURE]
C. Roux, M. Andreani, and M. Rapin [1969] 20 p refs In FRENCH Presented at the Intern. Conf. on the Phys. Properties of Solids under Pressure, Grenoble, France

(CEA-CONF-1487; CONF-690908-2) Avail: AEC Depository Libraries

The phase diagram of bismuth was studied from 300 to 4.2 K and from 0 to 50 kbar with an equipment composed of a chamber and a piston of cylindrical form. This equipment allows the variations of resistance with pressure (temperature is left constant) or with temperature (initial pressure is blocked up) to be measured. An arrest point was found on curve representing the II yields III transformation (32 kbar, 162 K). This point could be a critical one. At 77 K the transformation III yields I shows a hysteresis estimated at 6 kbar: Bi III becomes a superconductor towards 7 K. NSA

N70-27804# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
RELAXATION IN SEVERAL MAGNETIC MATERIALS
Richard R. Bartkowski Nov. 1969 88 p refs
(Contracts N00014-67-A-0298-0006; N00014-67-A-0298-0005; N00014-67-A-0298-0008)
(AD-702415; TR-601) Avail: CFSTI CSCL 20/12

Investigations in several interesting materials were conducted over a wide temperature range with the use of the ferromagnetic resonance and parallel pump techniques. The materials investigated are CdCr2Se4, EuS, and NiFe2O4. The first two are ferromagnetic, NiFe2O4 is ferromagnetic and all are insulators. CdCr2Se4 was investigated from 4 degrees K to the Curie temperature by the parallel pump instability. Ferromagnetic resonance data extends to room temperature. The linewidth as measured by both techniques shows an abrupt rise in the vicinity of the transition temperature. EuS was investigated by the parallel pump instability in the low temperature region. Here the dominant source of relaxation is the three-magnon process. These data are compared with the linewidths calculated for this process. NiFe2O4 was investigated from 2 degrees K to room temperature by the parallel pump technique. Comparison of this with the available ferromagnetic resonance data shows that the latter is dominated by two-magnon processes. The parallel pump linewidth appeared to be that of a slowly relaxing impurity. Author (TAB)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N70-27095*# General Dynamics/Convair, San Diego, Calif.
PRELAUNCH OPERATIONS FOR A SPACE STORABLE PROPELLANT MODULE Final Report
1 May 1970 212 p refs Prepared in cooperation with Rocketdyne, Canoga Park, Calif.
(Contracts NAS7-742; NASw-1229; NAS7-741)
(NASA-CR-109833; GDC-BNZ69-013-8) Avail: CFSTI CSCL 21D

Results of a study are presented on the feasibility of prelaunch operations with a space storable propulsion module. It is concluded that: (1) In spite of their toxic, reactive, and cryogenic properties, oxygen difluoride and diborane or FLOX/methane propellants can be safely used. (2) The 3000 pounds of propellant, typical for retro propulsion on unmanned outer planet orbiters, can be handled in the same flow sequence successfully used for Surveyor and Mariner. (3) Personnel safety can be assured by a number of reasonable precautions. Toxic waste from routine blowdowns during tanking and draining should be neutralized or burned. In case of propellant module leakage, emergency drain provisions could be employed using the supply trailers as receivers. Thermal control based on a simple ground-based LN2 system can assure indefinite standby without venting. (4) The study uncovered no major technology roadblocks and indicates that prelaunch operations will not restrict the development of a space storable propulsion module. D.L.G.

N70-27159*# Propulsion Sciences, Inc., Melville, N.Y.
DROPLET VAPORIZATION WITH LIQUID HEAT CONDUCTION Final Report
V. D. Agosta and S. S. Hammer 10 Feb. 1970 80 p refs
(Contract NAS3-12030)
(NASA-CR-72672; PSI-70-2) Avail: NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Md. 20740 CSCL 21B

An analytical solution for droplet evaporation is presented. The governing differential equation includes finite liquid thermal conductivity within the droplet interior. The boundary conditions are a heat balance at the droplet surface, and finite temperatures at the droplet center. The effect of initial droplet size and temperature, droplet thermal conductivity and environmental gas pressure on temperature and vaporization rate histories are investigated. It is found that for the larger droplets, a dynamic equilibrium state is approached; i.e., the droplet surface regression rate parameter and the surface temperature approach common values. Author

N70-27461# Louvain Univ. (Belgium). Lab. of Inorganic Chemistry.
EXPERIMENTAL STUDY OF COMBUSTION IN SOLID PROPELLANTS AND IN GASEOUS SYTEMS Final Scientific Report
A. Van Tiggelen Dec. 1969 14 p refs
(Grant AF-EOOAR-69-0042)
(AD-701421; AFOSR-70-0404TR) Avail: CFSTI CSCL 21/2

Applying the technique of the analogical burner (multimicrojet burner) it is possible to measure the heat transferred from the burning zone to the surface of the burner which plays the role of the regressing surface of a burning solid propellent. The study has been achieved in two extreme cases of burning conditions: fully individual premixed flamelets and purely individual diffusion flamelets. The burning mixture consisted of methane, oxygen and nitrogen. A theoretical interpretation is given to the experimental data. The second part of this report consists in an introduction to the comparative study of chemiluminescence and chemiionization in flames propagating in the most varied mixtures of gaseous fuels and oxidizers. Author (TAB)

N70-27716*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
PREDICTION OF ELECTRON DENSITY AND COLLISION CROSS SECTION. VOLUME 2: EQUILIBRIUM ELECTRON DENSITY PREDICTION, A MATHEMATICAL MODEL Final Report
J. H. Mc Dermit Feb. 1970 45 p refs
(Contract NAS8-21022)
(NASA-CR-102612; LMSC/HREC-D162139-2; HREC-1022-3) Avail: CFSTI CSCL 21I

Electron density, or the degree of ionization of gas species is of interest due to radio frequency attenuation caused by the presence of electrons. Formulation of a state-of-the-art mathematics model for predicting the degree of ionization of thermochemical systems at equilibrium conditions is given. The system of equations is nonlinear and is solved through a gradient search scheme. The solution has been automated, and the computer program is discussed. The system of equations which comprises the mathematical model is the Gibbs free energy function and the conservation equations for total atomic mass and neutral charge in the chemical system. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N70-26758*# Plasmadyne Corp., Santa Ana, Calif.
EXPLORATORY ELECTROMAGNETIC THRUSTER RESEARCH, PHASE 3, 23 JUNE – 23 DECEMBER 1969
A. C. Ducati and R. G. Jahn Feb. 1970 69 p refs
(Contract NAS1-9297)
(NASA-CR-66923; FR-020-9297) Avail: CFSTI CSCL 21C

Performance evaluation methods for MPD arc jets operating in the quasi-steady mode are described. This type of operation is obtained by running the thruster at a high power level for a pulse period of the order of one millisecond; a period which is short enough to avoid the major problems associated with continuous high power operation, but long enough that steady state operating conditions appear to be attained during most of the pulse duration. The system consists of a thruster, a pulse generating network, a method for starting the arc, and a method for providing the proper flow of propellant during the pulse. The quasi-steady work is expected to supplement rather than replace results obtained from continuously operating thrusters in improving our understanding of MPD thruster performance. The work reported is concerned primarily with setting up an initial engine system and with developing techniques for measuring performance with quasi-steady operation. Author

N70-26809*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INFLATABLE, TRANSPIRATION COOLED NOZZLE Patent Application
Donald E. Pryor, James R. Thompson, Jr., Benjamin K. Holmes, Charles N. Scott, and William W. Sowa, inventors (to NASA) Filed 12 Mar. 1970 11 p
(Contracts NAS8-20073; NAS8-21476)
(NASA-Case-MFS-20619; US-Patent-Appl-SN-18982) Avail: CFSTI CSCL 21H

A rocket engine nozzle skirt for increasing the expansion ratio of a main engine nozzle is described. The skirt is fabricated from a woven, double wall, fabric material which can be folded back around the main nozzle and later inflated to achieve its desired shape. The exterior surface of the nozzle extension is coated with a suitable sealant leaving the inner wall unsealed and with a porosity such that the inflation gas bleeds through to provide transpiration cooling of the nozzle skirt. NASA

N70-26815*# Hughes Aircraft Co., Los Angeles, Calif.
ION THRUSTER Patent Application
Wolfgang Knauer and Robert L. Poeschel, inventors (to NASA) Filed 26 Nov. 1969 9 p Sponsored by NASA
(NASA-Case-LEW-10770-1; US-Patent-Appl-SN-880246)
Avail: CFSTI CSCL 21C

Electrostatic ion thrusters having uniform beam profiles utilize radial magnetic fields to achieve uniformity in electron density and energy. In each thruster neutral particles of a gaseous propellant enter an ionization chamber where high velocity electrons ionize the particles to form plasma. A screen grid and an accelerator grid at the downstream end of the ionization chamber focus and accelerate ions that reach that end. A disk shaped electrode at the opposite end of the chamber from the screen grid forms an anode that is positively charged relative to a cathode. NASA

N70-26886# Aerospace Research Labs. Wright-Patterson AFB, Ohio.
THRUST AUGMENTATION CONSIDERATIONS FOR STOL AND EXTENDED CRUISE PROPULSION Final Report
William S. Campbell Nov. 1969 26 p refs
(AD-701728; ARL-69-0182) Avail: CFSTI CSCL 1/3

The application of thrust augmentation concepts to short take-off and landing (STOL) aircraft propulsion is described for some typical installations. Aerodynamic and ejector thrust effects are treated separately so that the performance of the ejector-powered wing can be calculated as that of a jet-flapped airfoil and the ejector thrust components then added. Some considerations on the performance of the ejector-powered wing in cruise are included. A program for ejector calculations is given. Author (TAB)

N70-27003# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN EXPERIMENTAL INVESTIGATION OF SUPERSONIC TURBINE GRIDS
V. B. Panfilovich 18 Sep. 1969 14 p refs Transl. into ENGLISH from Aviats. Inst., Kazan (USSR), no. 93, 1967 p 77–83
(AD-701213; FTD-MT-24-156-69) Avail: CFSTI CSCL 21/5

A test stand for experimental evaluation of air directing structures in turbines is described. The air is drawn by a vacuum pump through the filter, the Laval nozzle, the structure being tested, and into the air outlet. The inserts allow the adjustment of the nozzle for a desired ratio of the critical to the output cross section of the nozzle, while the rotation of the test structure together with the protective glasses, as well as the adjustment of the inserts with respect to the body of the aerodynamic tube, establishes the required angle of air-flow to the structure and the size of the gap between the structure and the outlet of the nozzle. The operation, calibration, and the results of tests are extensively discussed. Photographs of supersonic airflow through the channels between buckets are included. Author (TAB)

N70-27029*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A SUB-MILLIPOUND MERCURY ELECTRON-BOMARDMENT THRUSTER
Paul D. Reader, Shigeo Nakanishi, Walter C. Lathem, and Bruce A. Banks Jun. 1970 20 p refs Presented at the 6th Propulsion Joint Specialists Conf., San Diego, Calif., 15-19 Jun. 1970; sponsored by AIAA
(NASA-TM-X-52803) Avail: CFSTI CSCL 21C

Several similar 5 cm diameter electron bombardment ion thrusters were investigated. A series of tests used to improve the performance of the thruster components are discussed. Cathode pole piece and baffle position and geometry significantly influence ion chamber performance and are used to tailor the discharge characteristics to obtain desired operational modes. Both chamber and neutralizer emitters are enclosed hollow cathode types. The chamber cathode operates on the total flow through the discharge chamber. The neutralizer cathode has been operated successfully at mercury flow rates below 2 mA of equivalent flow while coupled to an operating thruster beam. All thruster tests were conducted with single, glass coated grids. Tests of glass-coated grids designed to provide single and multiple axis electrostatic thrust vectoring are also discussed. A thruster system design resulting from the above component tests is described. Overall thruster efficiencies of 20 percent at a specific impulse of 1800 sec have been demonstrated at a thrust level of 0.36 mlb. Author

N70-27043# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRINCIPLES OF SOLID-FUEL ROCKET DESIGN

Ya. M. Shapiro et al 19 Nov. 1969 502 p refs Transl. into ENGLISH of the book "Osnovy Proyektirovaniya Raket na Tverdom Toplive" USSR, 1968 p 1–352
(AD-701235; FTD-HT-23-268-69(JPRS)) Avail: CFSTI CSCL 21/8

On the basis of materials published in the Soviet and non-Soviet press, the book offers a survey of the designs of guided and unguided rockets for various purposes and having solid-fuel engines. The design elements of individual assemblies and units, the composition layouts of rockets, and questions relating to the regulation of thrust as regards quantity and direction are examined. Engineering methods for calculating the elements of trajectories of guided and unguided rockets are given, as they apply to the problem of ballistic designing. The factors affecting the scatter of unguided rockets are examined. Optimum parameters for rockets and design units are evaluated via synthesis and analysis of weight equations for rockets, approximate external ballistic relations being utilized. The fundamentals of calculations of solid-fuel rocket engines and of charges for them as regards sturdiness are set forth. Author (TAB)

N70-27119*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
BEHAVIOR OF NOZZLES AND ACOUSTIC LINERS IN THREE-DIMENSIONAL ACOUSTIC FIELDS Quarterly Report, 1 Dec. 1969 – 28 Feb. 1970
Ben T. Zinn, Allan J. Smith, Jr., and B. Robert Daniel Feb. 1970 22 p refs
(Grant NGL-11-002-085)
(NASA-CR-102614) Avail: CFSTI CSCL 21H

Frequency responses of supercritical nozzles and acoustic liners were investigated. It was theoretically shown that by measuring instantaneous pressure amplitudes at various locations along the tube, and then substituting the experimental data into the theoretical expression results in a set of equations, that the nozzle admittance function can be determined. A computer program capable of converting the experimental data into meaningful results was developed. J.M.C.

N70-27147*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE EVALUATION OF FOUR EXHAUST NOZZLES FOR AFTERBURNING TURBOJET ENGINE
George V. Darchuk and Joseph R. Balombin Washington May 1970 15 p refs
(NASA-TM-X-2014; E-5535) Avail: CFSTI CSCL 21E

Sea level static tests were made of three different nozzle designs suitable for application to a supersonic cruise aircraft. At military power, results obtained with a plug nozzle, a variable flap ejector, and an auxiliary inlet ejector were compared with that of a convergent primary nozzle. At maximum afterburning only the primary and two ejector nozzles were tested. Based on the noise measurements made, it was calculated that for a flyover at 1000 ft altitude, the maximum perceived noise level on the ground would be 6 dB less with the plug nozzle than with the auxiliary inlet ejector. Author

N70-27348*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANALYTICAL METHOD FOR DETERMINING THE MELT-LAYER THICKNESS AND REGRESSION RATES FOR A HYBRID OR TRIBRID ROCKET MOTOR
Walter Brooks Drew Washington May 1970 65 p refs
(NASA-TN-D-5699) Avail: CFSTI CSCL 21H

The effect of fuel thermal conductivity on melt layer buildup and regression rate was investigated. The effect of heat input to the fuel surface on melt layer buildup was determined. Analytical results based on laboratory-size motors indicate that the slab burner and cylindrical grain configurations will produce melt layer thicknesses greater than the experimentally determined critical value for stripping of 0.125 inch and will permit the liquid fuel to be stripped away from the fuel surface by the viscous forces in the gaseous boundary layer. This condition will produce low combustion efficiencies in the tribrid rocket system. Calculations also show that the thickness of the melt layer is a strong function of the convective and radiative heat input to the fuel surface and can be minimized by manipulating surface heat input through flow rates and grain geometry. Author

N70-27384*# Rocketdyne, Canoga Park, Calif.
GENERALIZED PROPULSION SYSTEM MODEL, PHASE 1 Interim Report, 12 Jan. – 20 Mar. 1970
John J. Boehnlein 17 Apr. 1970 38 p refs
(Contract NAS9-10319)
(NASA-CR-108418) Avail: CFSTI CSCL 21H

The initial effort was spent evaluating analytical techniques which may be used to characterize the behavior of pressure-fed rocket engine system. An existing model, which is used to predict start and cutoff transients in pressure-fed rocket engines, is used as a starting point. In order to supply additional capability, a study was made to determine the methods to be used to simulate two phase flow, a simple pressurization system, 600 hertz frequency response, simulation of injector and thrust chamber at cutoff and components such as valves, cavitating ventures, and orifices. After selection of the analytical techniques to be used an outline of the new program was made. This outline identifies the subroutine and function subprograms needed and allowed an estimate of program size to be made. In order to use the program on the NASA computer, its size was reduced from 72,000 words to approximately 42,800. Author

N70-27578*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONDENSERS AND BOILERS FOR STEAM-POWERED CARS: A PARAMETRIC ANALYSIS OF THEIR SIZE, WEIGHT, AND REQUIRED FAN POWER
William C. Strack Washington May 1970 60 p refs
(NASA-TN-D-5813; E-5275) Avail: CFSTI CSCL 13A

Fan power is presented over a range of design and operating variables such as size, heating rate, and ambient air temperature. It is found that practical condensers are about four or five times the size of conventional automobile radiators. Boiler size is not necessarily large; 100-lb (45-kg) boilers are possible for 4000-lb (1815-kg) passenger cars. The weight and fuel economy of a complete propulsion system are estimated to be quite comparable to today's internal-combustion systems. Author

N70-27591*# Rocketdyne, Canoga Park, Calif.
TRIDYNE ATTITUDE CONTROL THRUSTER INVESTIGATION Final Report
H. E. Barber and C. H. Buell 3 Apr. 1970 124 p refs
(Contract NAS7-719)
(NASA-CR-109829; R-8144) Avail: CFSTI CSCL 21H

The results of an experimental program to evaluate and demonstrate the feasibility of a Tridyne attitude control thruster are reported herein. Substantiating data are presented for catalyst selection and optimization. Criteria for the design of a Tridyne attitude control module with preconditioning heaters are described. The design, fabrication, and testing of a flightweight thruster is detailed. Author

N70-27637*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF EXPERIMENTAL AND CALCULATED HELIUM REQUIREMENTS FOR PRESSURIZATION OF A CENTAUR LIQUID OXYGEN TANK

Raymond F. Lacovic Washington May 1970 23 p refs
(NASA-TM-X-2013; E-5539) Avail: CFSTI CSCL 21H

Ramp and expulsion pressurization tests with helium as the pressurant were conducted in a thick-walled liquid oxygen tank with the shape and approximate volume of a Centaur tank. A total of 14 rams and 22 expulsion tests were conducted. Twelve of the expulsion tests were conducted with helium injected directly into the tank ullage and ten of the expulsion tests were conducted with helium injected beneath the liquid surface. The quantity of helium required in the tests was in good agreement with the helium requirements generated by pressurization computer programs. Author

N70-27692# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ROCKET ENGINES
T. M. Melkumov et al 5 Dec. 1969 632 p refs Transl. into ENGLISH of the book "Raketnye Dvigateli" Moscow, Mashinostroyeniye, 1968 p 1–511
(AD-701238; FTD-MT-24-290-69; FTD-HT-23-1531-68) Avail: CFSTI CSCL 21/8

The book discusses fundamental problems in the theory and construction of liquid and solid rocket engines. Problems pertaining to the strength of liquid rocket engines and solid rocket engines are discussed; guidance and automatic control systems of rocket engines (RE) are analyzed, and types of process instability appearing in rocket engines are considered. Material published in the foreign and Soviet literature is used as a basis for information given on RE designs, fuels, cooling systems, turbopump units, gas generators, and applications of nuclear energy in rocket engines. Author (TAB)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N70-26538# Central Research Inst. for Physics, Budapest (Hungary).
DENSITY SPECTRUM OF THE PENETRATING COMPONENT OF THE EXTENSIVE AIR SHOWERS
B. Betev, N. Bogdanova, T. Stanev, and G. Valas 1 Oct. 1969 3 p refs
(KFKI-27/1969) Avail: AEC Depository Libraries

The exponent of the muon-density spectrum of the EAS was determined at the altitude 2925 m a.s.l. on the basis of 16,926 registered showers by means of an apparatus consisting of four hodoscoped G-M counter sets located on the corners of a 8m x 8m square under 30 cm lead. The method used to analyze the data made it possible to eliminate the effect of the multiplication in the lead. A value gamma = 2.35 + or − 0.05 was obtained for the exponent of the spectrum. Author (NSA)

N70-26631# Atomic Energy Commission, New York. Health and Safety Lab.
CONSIDERATION OF COSMIC-RAYS AS SECONDARIES
Keran O'Brien Nov. 1969 24 p refs
(HASL-216) Avail: CFSTI

Because of the striking resemblance of the galactic cosmic-ray proton spectrum to secondary spectra produced in nucleonic cascades, the nucleon–meson and associated electromagnetic cascades in a 600 g/sq cm thickness of hydrogen in the Galaxy have been calculated. On irradiation by 7.5 x 10 to the 41st power erg/s of high-energy protons, secondary protons, electrons, and photons emitted and transported through the Galaxy can be compared with experimental proton, electron, and photon measurements. The proton spectrum agrees with experimental data above 10 GeV. Electrons also fit the experimental data, whereas inclusion of electrons from electromagnetic showers, initiated by neutral pion decay, results in a spectrum two orders of magnitude too intense, suggesting that the emission of shower electrons is suppressed by intense magnetic and radiation fields. The fraction of positrons in the experimental cosmic electron flux is in agreement with this view, as it is approximately the value expected from decay electrons above about 10 GeV. Author (NSA)

N70-26867# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
GRAPHS OF SELECTED DATA FROM SATELLITE 1963 38 C FOR 1967
David S. Beall Apr. 1969 230 p refs
(Contract NOw-62-0604-c)
(AD-701314; APL-TG-1050-5) Avail: CFSTI CSCL 4/1

Satellite 1963 38C was launched on September 28, 1963 into a circular, polar orbit at 1100 km altitude. Its instrumentation includes silicon surface barrier detectors, designed to measure mirroring electrons and protons, and Li-drifted cubes for omnidirectional measurement. The electron spectrometer measures integral flux for Ee = or > 0.28, 1.2, 2.4, and 3.6 Mev. The proton spectrometer measures protons with energies in the ranges 1.2 to 2.2, 2.2 to 8.2, 8.2 to 25, and 25 to 100 Mev. Three omnidirectional detectors measure fluxes of particles for which Ee greater than 0.28 Mev, Ep greater than 2.2 Mev; Ee greater than 0.41 Mev, Ep greater than 8.5 Mev; and Ee greater than 1.8 Mev, Ep greater than 25 Mev. At the time of the preparation of this report (winter 1968/1969) the satellite had functioned extremely well for more than five years, and its eventual demise could not be inferred from the data quality. In the first five volumes, raw data from 1963 through 1967 are presented versus time and B(the magnitude of the local magnetic field) for selected L (a parameter approximately constant along lines of force) values (1.20 = or < L = or < 20 earth radii). Author(TAB)

N70-26893# New Hampshire Univ., Durham. Dept. of Physics.
RESEARCH DIRECTED TOWARD EVALUATION OF RADIATION ENVIRONMENT OF NEAR-EARTH SPACE Final Report, 17 Jun. 1968–15 Dec. 1969
Roger L. Arnoldy 15 Dec. 1969 38 p refs Submitted for publication
(Contract F19628-68-C-0294)
(AD-701640; AFCRL-70-0087) Avail: CFSTI CSCL 4/1

As a result of the correlation study of the sudden intensity increases seen by the ATS-1 electron spectrometer with the occurrence of magnetic substorms the following conclusions are reached: (1) Electrons are produced in the 50-150 kev energy range as observed at 6.6Re during a magnetic substorm. (2) The electrons are produced at or near the midnight meridian and then drift on closed field lines around the earth. (3) The electron bunch produced as a result of the substorm in 75% of the 60 events studied is associated with precipitation observed by riometers as it drifts. (4) The frequency of occurrence of such particle substorms indicates that they might represent a quasi-steady source of electrons for the trapped radiation. Rapid fluctuations in the intensity of precipitated energetic particles during a bright aurora have been studied. The fluctuations occurred only during the period of peak precipitation and in close correlation with the peak precipitation and in close correlation with the westward surge of a bright auroral band preceding break-up. Dynamic spectral analysis of the data showed no sustained periodicities. Author (TAB)

N70-26894# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
GRAPHS OF SELECTED DATA FROM SATELLITE 1963 38 C FOR 1966
David S. Beall Apr. 1969 228 p refs
(Contract NOw-62-0604-c)
(AD-701313; APL-TG-1050-4) Avail: CFSTI CSCL 4/1

Satellite 1963 38C was launched on September 28, 1963 into a circular, polar orbit at 1100 km altitude. Its instrumentation includes silicon surface barrier detectors, designed to measure mirroring electrons and protons, and Li-drifted cubes for omnidirectional measurement. The electron spectrometer measures integral flux for Ee = or > 0.28, 1.2, 2.4, and 3.6 Mev. The proton spectrometer measures protons with energies in the ranges 1.2 to 2.2, 2.2 to 8.2, 8.2 to 25, and 25 to 100 Mev. Three omnidirectional detectors measure fluxes of particles for which Ee > 0.28 Mev, Ep > 2.2 Mev; Ee > 0.41 Mev, Ep > 8.5 Mev; and Ee > 1.8 Mev, Ep > 25 Mev. Author (TAB)

N70-26939# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE STUDY OF THE LOW-ENERGY SOLAR AND CELESTIAL GAMMA RADIATION Final Report, 18 Mar. –17 Sep. 1969
Henry F. Helmken Oct. 1969 9 p
(Contract F19628-68-C-0297)
(AD-701248; AFCRL-69-0545) Avail: CFSTI CSCL 4/1

Theoretical and design studies were conducted on gamma-radiation detectors for the energy range from 0.5 to 15 Mev. A NaI crystal detector and a gas Cerenkov detector were selected and used to obtain the gamma-ray growth curve from sea level to 125,000 ft. Author (TAB)

N70-27019*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
X RADIATION IN BINARY STARS
Klaus Schocken 13 Mar. 1970 17 p refs
(NASA-TM-X-53998) Avail: CFSTI CSCL 03B

The properties of close binary stars and old novae as they are known will be summarized from the literature sources listed in the bibliography. A binary system originates with or results from the splitting of a single star into two components caused by rotational instability during the contraction of the star. The assumption is made that, to become a nova, it is a necessary condition for the star to be a member of a close binary system consisting of a blue and a red star, with a stream of gas flowing from the red to the blue star and forming a shell around the blue star to generate the observed bright emission lines that indicate that this gaseous shell moves with the blue star. Assuming that the explosive process has taken place in the nova, a shock wave will penetrate the surface, forming an expanded atmosphere in a time that is too short for appreciable loss of radiation. When an electric field exists in a plasma with a density such that the electrons whose velocity surpasses a certain critical value will gain more energy from the field than they lose by collisions, runaway electrons will be generated. The hypothesis is made that runaway electrons are the source of deceleration X radiation in the atmosphere of a nova. Author

N70-27062# Atomic Energy of Canada, Ltd., Chalk River, (Ontario).
COSMIC RAY NM-64 NEUTRON MONITOR DATA, 13, AND MONTHLY GRAPHS, MAY – AUGUST 1969
J. F. Steljes Mar. 1970 70 p revised
(AECL 3454-Rev) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $1.50

Uncorrected and barometer-corrected results from the cosmic ray stations in Canada using equipment maintained by AECL are given in tabular form for the period from May to August 1969. Normalized graphs are given for the same period. Author

N70-27109 National Lending Library for Science and Technology, Boston Spa (England).
A THERMAL MODEL OF THE ACTIVE REGION OF THE SOLAR CORONA
I. L. Beigman et al Jan. 1970 27 p refs Transl. into ENGLISH from Russian report
(NLL-CTO/705-(9091.9F)) Avail: Natl. Lending Library Boston Spa, Engl.: .3 NLL photocopy coupons

The X-ray flux density in the resonance lines of the most abundant ions in the solar corona are calculated for a wide range of temperatures. The rates of excitation, ionization, and recombination obtained by numerical methods are used. The calculated fluxes were used to analyze experimental data on the emission of the active regions in the range spectra. It was assumed that the photospheric abundance of C, N, and O was correct and the abundances of Ne, Mg, and Fe were calculated from experimental data. Author

N70-27125*# Techtran Corp., Glen Burnie, Md.
RADIO-ASTRONOMY METHOD OF MEASURING ABSORPTION OF RADIO WAVES IN THE IONOSPHERE [RADIOASTRONOMICHESKIY METOD IZMERENIY VELICHINY POGLOSHCHENIYA RADIOVOLN V IONOSFERE]
V. V. Beilkovich et al Washington NASA May 1970 28 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiotiz. (Gorkiy), v. 12, no. 10, 1969 p 1439–1454
(Contract NASw-2037)
(NASA-TT-F-12897) Avail: CFSTI CSCL 04A

The principles of the method are described in relation to variations of cosmic radio radiation, ionospheric characteristics and phenomena, and solar activity, along with such major shortcomings of the method itself as the required long observation time with highly sensitive and stable instrumentation. The dual frequency and polarization methods are outlined. The components and principal varieties of riometers are described, together with their antenna systems. The A2 method of analyzing errors in absorption measurement is described. Other sources of error such as noise are discussed, as are the principal trends in the field today. Author

N70-27197# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
SUPPLEMENT TO KLEINHEUBACHER REPORTS, VOLUME 13: SOLAR TERRESTRIAL RELATIONS [BEILAGE ZU DEN KLEINHEUBACHER BERICHTEN, BAND NR. 13: SOLAR-TERRESTRISCHE BEZIEHUNGEN]
1969 59 p In GERMAN Presented at the Joint Meeting of the Ionospheric Working Group of the Ger. Natl. URSI Comm. and the Comm. for Wave Propagation of the NTG, Kleinheubach, West Ger.
Avail: CFSTI

At the occasion of the joint conference of the study group 'Ionosphere', the German URSI national committee and the 'Commission on Wave Propagation' of the NTG, held at Kleinheubach in 1968, a floor discussion was held on the subject Terrestrial Relations'. The discussion was subdivided into four parts: 1) normal eruptions; 2) proton-flares; 3) earth storms; 4) general activity. ESRO

N70-27283*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NEW COMPONENT OF COSMIC GAMMA RAYS NEAR ONE MEV OBSERVED BY THE ERS-18 SATELLITE

James I. Vette, Duane Gruber (California Univ., La Jolla), James L. Matteson (California Univ., La Jolla), and Laurence E. Peterson (California Univ., La Jolla) May 1970 22 p refs
(NASA-TM-X-63912; X-601-70-183) Avail: CFSTI CSCL 04A

Data on the total omnidirectional cosmic gamma-ray flux in the 0.25 MeV to 6 MeV range obtained by the Environmental Research Satellite-18 (ERS-18) are reviewed. The ERS-18 measurements indicate an additional component of gamma-rays in the 1–6 MeV range above that expected by simple extrapolation of the spectrum below 1 MeV to higher energies. Author

N70-27321*# Techtran Corp., Glen Burnie, Md.
THE ELECTROMAGNETIC FIELD WHICH ARISES UPON IONIZATION OF AIR BY A POINT SOURCE OF GAMMA RADIATION IN THE ELECTRICAL FIELD OF THE EARTH [OB ELEKTROMAGNITNOM POLE, VOZNIKAYUSHCHEM PRI IONIZATSII VOZDUKHA TOCHECHNYM ISTOCHNIKOM GAMMA-IZLUCHENIYA V ELEKTRICHESKOM POLE ZEMLI]
Yu. V. Gutop et al Washington NASA May 1970 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Kiev), v. 12, no. 10, 1969 p 1573–1576
(Contract NASw-2037)
(NASA-TT-F-12899) Avail: CFSTI CSCL 04A

The perturbation of the terrestrial electric field in air ionized by a point source of gamma radiation is determined. It is assumed that the conducting ionized area has no clearly expressed boundary and that the dimension of the perturbed area is small in comparison with the lengths characterizing the change of the terrestrial field and the natural conductivity of the air. Author

N70-27347*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE GENERATION OF X-RAYS IN PLANETARY NEBULAE
Klaus Schocken 12 Feb. 1970 19 p refs
(NASA-TM-X-53996) Avail: CFSTI CSCL 03B

Planetary nebulae emit continuous radiation which originates by free-free transitions involving kinetic energy losses of free electrons in the electrostatic fields of ions. These free-free emissions are responsible for the radiation observed in the radio frequency spectra. They also contribute in the visible and infrared regions. Therefore, if X-rays are generated by planetary nebulae, it can be assumed that they will also be produced by free-free transitions. However, free-free radiation will be measured along with free-bound radiation. A formula is given for the intensity of the combined continuum for an ionized gas with a Maxwellian distribution of the electron velocities. Author

N70-27362# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
GRAPHS OF SELECTED DATA FROM SATELLITE 1963 38C FOR 1963
David S. Beall Apr. 1969 155 p refs
(Contract NOw-62-0604-c)
(AD-701310; APL-TG-1050-1) Avail: CFSTI CSCL 4/1

Satellite 1963 38C was launched on September 28, 1963 into a circular, polar orbit at 1100 km altitude. Its instrumentation includes silicon surface barrier detectors, designed to measure mirroring electrons and protons, and Li-drifted cubes for omnidirectional measurement. The electron spectrometer measures integral flux for Ee = or > 0.28, 1.2, 2.4, and 3.6 Mev. The proton spectrometer measures protons with energies in the ranges 1.2 to 2.2, 2.2 to 8.2, 8.2 to 25, and 25 to 100 Mev. Three omnidirectional detectors measure fluxes of particles for which Ee > 0.28 Mev, Ep > 2.2 Mev; Ee > 0.41 Mev, Ep > 8.5 Mev; and Ee > 1.8 Mev, Ep > 25 Mev. The 1963 report also contains an appendix section that gives certain details of the orbit coverage and data reduction methods. Author (TAB)

N70-27363# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
GRAPHS OF SELECTED DATA FROM SATELLITE 1963 38C FOR 1964
David S. Beall Apr. 1969 208 p refs
(Contract NOw-62-0604-c)
(AD-701311; APL-TG-1050-2) Avail: CFSTI CSCL 4/1
For abstract see N70-27362.

N70-27364# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
GRAPHS OF SELECTED DATA FROM SATELLITE 1963 38C FOR 1965
David S. Beall Apr. 1969 224 p refs
(Contract NOw-62-0604-c)
(AD-701312; APL-TG-1050-3) Avail: CFSTI CSCL 4/1
For abstract see N70-27362.

N70-27374# Aerospace Corp., El Segundo, Calif. Lab. Operations.
MEASUREMENTS OF TRAPPED ALPHA PARTICLES: L VALUES BETWEEN 2 AND 4.5, MARCH–JUNE 1969
J. B. Blake and G. A. Paulikas 15 Nov. 1969 16 p refs
(Contract F04701-69-C-0066)
(AD-701059; TR-0066(5260-20)-9; SAMSO-TR-70-9) Avail: CFSTI CSCL 4/1

Measurements of alpha particles and protons at L values between 2 and 4.5 are presented. The results are compared with theoretical predictions of the relative abundances of protons and alpha particles and the spatial location of peak intensities. Author (TAB)

N70-27427# National Lending Library for Science and Technology, Boston Spa (England).
COSMIC RAYS AND THE EARTH'S ATMOSPHERE
L. I. Miroshnichenko 28 Nov. 1969 19 p refs Transl. into ENGLISH from Akad. Nauk (Moscow), no. 5, 1969 p 18–29
(NLL-M-7969-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Eng.l: .2 NLL photocopy coupons

The effect that cosmic rays have on the earth's atmosphere was studied concurrently with the effect the earth has on cosmic ray deterioration. Absorption of cosmic rays in the atmosphere was related to the barometric cosmic ray effect. The study of temperature effects included an estimation of fluctuations of temperature in the earth's atmosphere, the intensity of solar flares, and meteorological effects. Wide atmospheric showers and the spectrum of cosmic rays are examined. The method of coupling coefficients was used to determine the cosmic ray spectrum. Anomalous ionization in the lower ionosphere and solar cosmic rays is discussed, as well as the isotopic composition of air. S.S.

N70-27561*# Maryland Univ., College Park. Inst. for Molecular Physics.
CORRELATION OF A SOLAR FLARE WITH A VISUAL AURORA
J. W. Meriwether, Jr., W. M. Benesch, and S. G. Tilford (Naval Res. Lab.) [1969] 15 p refs
(Grants NGL-21-002-008; NsG-398)
(NASA-CR-109869; AD-686456) Avail: CFSTI CSCL 03B

On February 13, 1967 at 1746 UT, the brightest flare of that year erupted from the surface of the sun. Approximately 56 hours later, the sudden commencement of a magnetic storm was recorded by many observatories around the world. Midway between the worldwide sudden commencement and the termination of the magnetic storm, there occurred at Ft. Churchill an aurora attaining nearly IBC III and an accompanying local negative magnetic bay. Measurements were made on this aurora as one of a series investigated with a multiple channel photometer

simultaneously recording ten wavelength bands. The aurora of February 16 appeared normal under casual observation, but a detailed examination of its emission structure has turned up a number of deviations from other aurorae studied. It is concluded that the magnetic storm is primarily responsible for these unusual effects. Author (TAB)

N70-27748# Scientific Translation Service, Ann Arbor, Mich.
QUESTIONS ABOUT RADIATION
V. Dolezal et al [1969] 11 p refs Transl. into ENGLISH from Radar (Prague), no. 1, 1968 p 49–51 Prepared for Oak Ridge Natl. Lab.
(ORNL-TR-2219) Avail: CFSTI

The information about ionizing radiation in outer space is summarized in the following categories: galactic cosmic radiation, ionizing radiation from solar eruptions, geomagnetically trapped particles, secondary radiation from interaction of primary particles with the materials of spaceship, and the possibility of instantaneous direct irradiation of spaceship crews by nuclear explosions. Permissible radiation doses are discussed in relation to these types of radiation in space. The radiation doses received to date by astronauts on their flights are reviewed. NSA

N70-27769# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Ionosphaerenphysik.
CORRELATIONS BETWEEN SOLAR ACTIVITY AND THE LOWER IONOSPHERE [KORRELATIONEN ZWISCHEN SONNENTAETIGKEIT UND UNTERER IONOSPHAERE]
Heinrich Schwentek *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 121–125 refs In GERMAN; ENGLISH summary (See N70-27752 13-13)
Avail: CFSTI

While the solar radio flux on 2800 MHz (Ottawa) and the sunspot number R (Zurich) show a rather good linear correlation, this is not true for R and the solar X-ray flux. Radio wave absorption data at constant solar zenith angle on 2.61 MHz, determined daily from recordings of the diurnal variation over 7 years, show a variation of the winter anomaly around the sunspot minimum (1964 and 1965), and an increase of absorption from spring to autumn depending on sunspot number. Thus, the correlation between sunspot number and adsorption is a function of season. The influence of magnetic activity on absorption at middle latitudes is rather low (about 6%). It is also shown that the sunspot cycle is most effective in winter for the temperature at 35 km. Author (ESRO)

N70-27773# Tubingen Univ. (West Germany). Lehrstuhl fuer Theoretische Astrophysik.
ORIGINATING REGION AND FLUX OF SOLAR UV LINES [ENTSTEHUNGSBEREICH UND STRAHLUNGSSTROM SOLARER UV-LINIEN]
R. Maeckle *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 155–158 refs In GERMAN; ENGLISH summary (See N70-27752 13-13)
Avail: CFSTI

The photon flux of the X-ray and ultraviolet lines is calculated starting from a one-dimensional model of the chromosphere-corona transition region. Some of the problems arising in the formulation of theoretical models of the transition region are discussed. Author (ESRO)

N70-27774# Duesseldorf Univ. (West Germany). Inst. fuer Theoretische Physik.
ON THE EQUAL INTENSITY OF NARROW-BAND SOLAR BURST EMISSIONS AT THE SINGLE AND DOUBLE PLASMA FREQUENCY [ZUM VERSTAENDNIS DER INTENSITAETSGLEICHHEIT SCHMALBANDIGER SOLARER BURSTEMISSIONEN BEI DER EINFACHEN UND DOPPELTEN PLASMAFREQUENZ]
R. W. Larenz *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 159–161 refs In GERMAN; ENGLISH summary (See N70-27752 13-13)
Avail: CFSTI

The nonlinear interaction of longitudinal plasma waves produces narrow band radiation at the doubled plasma frequency whilst the interaction of electron waves and ion waves, the latter being essentially low frequency sound waves, yields radiation near the fundamental plasma frequency. If electron and ion waves are excited (for instance, by shockwaves) with equal amplitudes of the electron and ion density variation, equal flux intensity in both radiation bands results, in spite of the very different magnitudes of the electric quantities associated with the primary electron waves. Author (ESRO)

N70-27775# Duesseldorf Univ. (West Germany). Inst. fuer Theoretische Physik.
THE INFLUENCE OF A MAGNETIC FIELD ON THE FREQUENCY SPECTRUM OF BURST EMISSIONS IN THE PLASMA FREQUENCY RANGE [DER EINFLUSS EINES MAGNETFELDES AUF DAS FREQUENZSPEKTRUM VON BURSTEMISSIONEN IM BEREICH DER PLASMAFREQUENZ]
R. W. Larenz *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 163–164 refs In GERMAN; ENGLISH summary (See N70-27752 13-13)
Avail: CFSTI

An analysis of the nonlinear interaction of longitudinal electron waves was extended to a plasma with a superimposed magnetic field. As this field flattens the branch of the dispersion relation corresponding to the preferential longitudinal waves around the plasma frequency, a widening of the radiation band located at the doubled plasma frequency in the zero field case results; the radiation being transmitted in the ordinary and the extraordinary mode of the Appleton–Hartee theory. For very strong magnetic fields the extraordinary mode disappears and the lower emission frequency of the ordinary mode approximates to the plasma frequency, the primary longitudinal waves exhibiting about half the plasma frequency in this case. Circular polarization results from the prevailing ordinary mode, the emission thus resembling that of a type 4 burst. Author (ESRO)

N70-27776# Tubingen Univ. (West Germany). Astronomisches Inst.
SHORT DESCRIPTION OF THE EXPANDED WEISSENAU RADIO SPECTROGRAPH. INVESTIGATIONS OF HARMONICS OF TYPE 3 RADIO BURSTS [KURZE BESCHREIBUNG DES ERWEITERTEN WEISSENAUER RADIOSPEKTROGRAPHEN. UNTERSUCHUNGEN UEBEF OBERWELLEN BEI TYP 3 RADIOBURSTS]
G. Kraemer *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 165–168 refs In GERMAN; ENGLISH summary
Avail: CFSTI

Some data on the frequency range extension of the Weissenau radiospectrograph are given. Some features of type 3 bursts, which show a statistical dependence of the central distance of the burst source on the solar disc are discussed and it is shown that the sources of bursts appearing in the frequency range above and below 160 MHz have a tendency to accumulate near the disc center and near the limb respectively, the mean velocity of type 3 burst sources, as calculated from the frequency drift and the Newkirk model of electron desnity, increases with increasing central distance of the correlated flares. Both features may be explained by assuming that many of the high frequency bursts have second harmonics and that the emission of both harmonics is directional with a dipole diagram for the first harmonic and quadrupole one for the second. Author (ESRO)

N70-27777# Tubingen Univ. (West Germany). Astronomisches Inst.

TYPE 2 RADIO BURSTS AND CORONAL MAGNETIC FIELD OVER AN ACTIVE CENTER [RADIOBURSTS VOM TYP 2 UND DAS KOROVALE MAGNETFELD UEBER EINEM AKTIVEN ZENTRUM]

O. Meyer *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 169–170 refs In GERMAN (See N70-27752 13-13)

Avail: CFSTI

Correlations of type 2 bursts with photospheric, chromospheric, and geophysical phenomena are investigated. The magnetic field in the corona is estimated for a few type 2 bursts. Author (ESRO)

N70-27778# Tubingen Univ. (West Germany). Astronomisches Inst.

MEASUREMENT AND EVALUATION OF SOLAR RADIO BURSTS USING MAGNETIC RECORDING [MESSUNG UND AUSWERTUNG SOLARER RADIOBURSTS MIT HILFE EINER MAGNETBANDREGISTRIERUNG]

H. Scheerer *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 171–172 In GERMAN (See N70-27752 13-13)

Avail: CFSTI

The results of a spectral measurement exist in the form of electric voltages, which are interpreted digitally. The digital signal is recorded on magnetic tape, and after rearranging the measurement values, curves (frequency profiles, time profiles) or areas (intensity layers) are printed out. This method is an improvement on the normal film recording of intensities. The dynamic spectra of intensity layers for instance show structures which could not have been perceived with the film method. Author (ESRO)

N70-27779# Bonn Univ. (West Germany).

THE PHENOMENOLOGY OF SOLAR FLARES IN THE MM-WAVE RANGE [DIE PHAENOMENOLOGIE SOLARER FLARES IM MM-WELLENGEBIET]

G. Feix *In* Fernmeldetech. Rentralamt Kleinheubacher Rept., Vol. 13 1969 p 173–183 refs In GERMAN; ENGLISH summary Prepared jointly with Max-Planck-Inst. fuer Radioastronomie (See N70-27752 13-13)

Avail: CFSTI

Sudden impulsive brightenings in H-alpha, bright white light points and regions of He-line emission indicate a highly excited flare core. White light emission (continuum) was observed from a number of flares and this optical continuum originates in the small and probably highly excited flare core, only lasts for a few minutes and, in general, has an intensity less than 10% of the photospheric continuum. To get full information on the initial flare and its core and to draw conclusions as to the physical nature of these flare areas, radio measurements were made at millimetre wavelengths to investigate the far-infrared continuum. Several flare-bursts are described, and the positions of the optically observed flare cores with respect to the positions of the radio source centres at 36 GHz were investigated and it was found that they coincided. Temperatures of 20,000 K to 80,000 K were obtained during the main phase, corresponding to the increased postburst. Higher temperatures of 10 to the 8th power K may occur in some cases at the initial impulsive phase, but, in general, at this phase temperatures of 200,000 K occurred. Only future observations with high geometrical resolution can provide full details of these active radiation areas. Author (ESRO)

N70-27780# Tubingen Univ. (West Germany). Astronomisches Inst.

DYNAMIC RADIO SPECTRA OF PROTON FLARES [DYNAMISCHE RADIOSPEKTREN VON PROTONENFLARES]

H. Urbarz *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., vol. 13 1969 p 185–198 refs In GERMAN; ENGLISH summary Sponsored jointly by Deut. Forsch. Gemeinschaft and Land Baden-Wuerttemberg *Its* Mitt. No. 109 (See N70-27752 13-13)

Avail: CFSTI

The propagation of energetic protons in interplanetary space and their effects in the earth's environment are discussed. Data from 12 type 4-solar radio bursts were compared with flare observations, geophysical effects and data from satellite monitors in order to detect proton emission emission. Nine of these bursts associated with proton flares showed a characteristic dynamic radio spectrum which was very different from that of the nonproton bursts. Proton bursts are of spectral type 4 and have a sudden rise to peak flux densities at least between 10 MHz and 100 GHz at almost the same time. There is a flux minimum at medium frequencies on the plot of peak flux versus frequency. The peak fluxes at meter wavelengths are about 10,000 to 100,000 flux units, and 1,000 to 10,000 units at centimeter and millimeter wavelengths. There is some evidence that the conditions in the upper corona favoring the emission of the broad-band class of type 4 bursts are also important for the energetic proton emission mechanism. Author (ESRO)

N70-27787# Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).

CO-ROTATION AND PRESSURE ANISOTROPIES IN THE SOLAR WIND [KOROTATION UND DRUCKANISOTROPIEN IM SONNENWIND]

Friedrich Meyer and Dieter Pfirsch *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 243–245 refs In GERMAN (See N70-27752 13-13)

Avail: CFSTI

The existing theories on co-rotation in the solar wind take into account the angular momentum transport by tensions in the spirally deformed magnetic field. On the earth's orbit they lead to azimuthal velocities of about 1 km/s. Observations of comet tails and measurements by the Vela satellites show velocities of 4 to 10 km/s. It is shown that the observed pressure anisotropies make a further contribution to the angular momentum of the solar wind. ESRO

N70-27788# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany).

OBSERVATIONS AND THEORIES OF THE QUIET SOLAR WIND [BEOBACHTUNGEN UND THEORIEN DES RUHIGEN SONNENWINDES]

Klaus Jockers *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 247–254 refs In GERMAN (See N70-27752 13-13)

Avail: CFSTI

New results from investigations on the solar wind are briefly reviewed. The sources, besides original work, the recent review articles of Axford (1968), and Wilcox (1968), as well as a lecture by Biermann (1969). Author (ESRO)

N70-27789# Eidgenossische Sternwarte, Zurich (Switzerland).

METHODS AND RESULTS OF SOLAR ACTIVITY FORECASTING [METHODE UND ERGEBNISSE DER SONNENAKTIVITAETSPROGNOSE]

M. Waldmeier *In* Fernmeldetech. Zentralamt. Kleinheubacher Rept., Vol. 13 1969 p 255–257 In GERMAN; ENGLISH summary (See N70-27752 13-13)

Avail: CFSTI

From observations covering more than 200 years, normalized sunspot-curves were deduced and each individual curve is determined by the parameter R sub M (highest smoothed sunspot-relative-number). As R sub M increases the rising time T becomes shorter: log R sub M = 2.73 –0.18 T (T in years). From

the steepness of the curve at its beginning the parameter R sub M and the run of the curve for the whole cycle can be predicted. Another useful solar prediction aid can be derived from an analysis in which all the curves intersect at about the point R = 50, 1.9 years before maximum. When the level R = 50 is reached, the maximum will be 1.9 years ahead; therefore T, R sub M and the whole curve of the running 11-year-cycle are known. Author (ESRO)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N70-26556*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROVISIONAL HOURLY VALUES OF EQUATORIAL Dst FOR 1964, 1965, 1966 AND 1967
Masahisa Sugiura and Shirley Cain Washington May 1970 63 p refs
(NASA-TN-D-5748; G-964) Avail: CFSTI CSCL 03B

Provisional hourly values of equatorial storm time variation are given for the years 1964 through 1967. Data from the magnetic observatories at Hermanus, Honolulu, and San Juan were employed. The method of data reduction is the same as that used previously. Author

N70-26557*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EMPIRICAL ANALYSIS OF UNACCELERATED VELOCITY AND MASS DISTRIBUTIONS OF PHOTOGRAPHIC METEORS
C. D. Miller Washington May 1970 56 p refs
(NASA-TN-D-5710; E-4917) Avail: CFSTI CSCL 03B

An empirical analysis was performed on data for 200 sporadic meteors. A bimodal log-normal equation was found for unaccelerated velocity distribution, by empirical curve fitting to match observed velocity distributions for meteoroids within 10 ranges of mass with due regard to failure of observation of faint meteors. An exponent of −1.34 was confirmed in the equation for cumulative influx rate of meteoroids relative to mass. An exponent of −3.87 was established for meteoroid velocity relative to Earth's atmosphere as used in an earlier weighting factor for correction of biasing effects of velocity and mass. Earlier theoretical results were closely approximated. Author

N70-26566*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Analysis Div.
PREDICTION OF THE POSITION AND VELOCITY OF A SATELLITE AFTER MANY REVOLUTIONS
S. S. Dallas 1 Apr. 1970 373 p refs
(Contract NAS7-100)
(NASA-CR-109650; JPL-TR-32-1267) Avail: CFSTI CSCL 22C

A systematic study on the prediction of the position and velocity of a satellite after many revolutions about the central mass is presented. It is shown that the methods of general perturbations are ideally suited for the prediction of orbits extending over many periods. The mathematical foundations for a theory of general perturbations using either the variation of coordinates or the variation of parameters, each with multivariable asymptotic expansions, as well as a theory of general perturbations using the variation parameters with Taylor's series expansions, are presented. Five theories of general perturbations are applied to the elementary problem of the damped linear harmonic oscillator. It is shown that the variation of coordinates and the variation of parameters, each with multivariable asymptotic expansions, are the only theories from this group that will yield the superior, uniformly valid approximation. A more realistic mathematical model of the motion of a satellite is qualitatively discussed; that is, the case where the satellite is perturbed by the asphericity of the central mass (second harmonic only), atmospheric drag, and the gravitational attraction of the sun, simultaneously, and where the initial conditions are not restricted to yield an equatorial orbit. Author

N70-26746# Brandeis Univ., Waltham, Mass. Dept. of Physics.
THE DISTRIBUTION FUNCTIONS OF STAR CLUSTERS
John Broderick (Ph.D. Thesis) Nov. 1969 68 p refs
(Contract F19628-69-C-0074)
(AD-701085; AFCRL-70-0048; SR-1) Avail: CFSTI CSCL 3/2

Two model globular clusters are constructed, each consistent with a given analytical surface density law known to fit well actual star clusters. One model is described by an isotropic distribution function (IDF) which depends on energy alone. The other model is described by the maximum energy distribution (MEDF) consistent with the given surface density. At small energies the IDF is exponential while at high energies it linearly approaches a finite value at the cutoff energy. The coefficient in the exponential approaches a constant as the concentration of the cluster increases, explaining the failure of the model to fit spherical galaxies. Arguments in favor of the abrupt cutoff are advanced which are based on the relaxation time being long compared with the circumgalactic orbital period, and on the change in the total escape energy as a cluster executes an elliptical circumgalactic orbit. It is shown that the truncated Maxwellian distribution in an MEDF is the distribution which is zero above the escape energy and constant below. For the given surface density the MEDF is computed by constructing a set of perturbing distribution functions which do not contribute to the density. These are added to the IDF in such a way as to maximize the entropy. Six perturbing functions were constructed and then used in finding the MEDF. Author (TAB)

N70-26760# Minnesota Univ., Minneapolis.
PROPER MOTION SURVEY WITH THE FORTY-EIGHT INCH SCHMIDT TELESCOPE. PART 21: DOUBLE STARS WITH COMMON PROPER MOTION
Willem J. Luyten 1 Aug. 1969 33 p
(Grant NSF GP-9506)
Avail: Issuing Activity

A catalog is presented which contains data for 1229 double stars found and measured in addition to those already cataloged. The catalog is arranged in four sections and contains the relatively few pairs of stars found on the southern Bruce plates, those found on the northern Bruce plates, those found on scattered pairs of plates from the Palomar Schmidt survey, and those found on 50 pairs of plates centered at +90, +84, +78, and +72. Author

N70-26761# Minnesota Univ., Minneapolis.
PROPER MOTION SURVEY WITH THE FORTY-EIGHT INCH SCHMIDT TELESCOPE. PART 18: BINARIES WITH WHITE-DWARF COMPONENTS
Willem J. Luyten 30 Jun. 1969 8 p ref
(Grant NSF GP-9506)
Avail: Issuing Activity

Binary stars found in proper motion surveys are cataloged according to their white-dwarf components. Data is presented for 120 such binaries photographed by either the Bruce or Palomar Schmidt telescope. R.B.

N70-26851# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANICS AND SPACE FLIGHT
G. L. Grodzovskii et al 24 Oct. 1969 95 p refs Transl. into ENGLISH from Mekhanika v SSSR Za 50 Let. (USSR), v. 1, 1968 p 265–319

(AD-700596; FTD-MT-24-234-69) Avail: CFSTI CSCL 22/3

The document deals with the mechanics of space flight and the new divisions of mechanics to which the progress of apace rocket technology gave life. Author (TAB)

N70-26924# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.

THE 3.3-mm BRIGHTNESS DISTRIBUTION OF THE QUIET SUN, JUNE 1964–JUNE 1966

Fred I. Shimabukuro 1 Dec. 1969 26 p refs Revised

(Contract F04701-69-C-0066)

(AD-700752; TR-0066(5230-46)-3; SAMSO-TR-70-17) Avail: CFSTI CSCL 3/2

Center-to-limb brightness distribution measurements of the quiet sun at a wavelength of 3.3 mm show that there is a slight limb brightening at this wavelength. Within the measurement accuracy of the system used, the limb brightening function is only radially dependent. At 3.3 mm, the measurements are consistent with a solar brightness curve that is flat to about $r = 0.8$ with a rapid increase to a peak value of about 1.3 at the limb. The results show that most of the central disk 3.3-mm emission comes from a thin layer of relatively constant temperature about 1500 to 3500 km above the photosphere. Author (TAB)

N70-26961 National Lending Library for Science and Technology, Boston Spa (England).

PHOTOSPHERIC AND CHROMOSPHERIC MAGNETIC FIELDS AND THE BRIGHTNESS OF FACULAE AND FLOCCULI [FOTOSFERNYE I KHROMOSFERNYE MAGNITNYE POLYA I YARKOST FAKELOV I FLOKKULOV]

T. T. Tsap Feb. 1970 17 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), v. 39, 1969 p 265–275

(NLL-RTS-5677) Avail: Natl. Lending Library, Boston Spa, Engl.: 27s 6d or 4 NLL photocopy coupons

Photospheric and chromospheric longitudinal magnetic fields and the brightness of faculae and flocculi are compared. The relationship between the brightness distributions at different depths in active regions of the sun is investigated. Author

N70-26978*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

COMPILATION OF LUNAR ORBITER TRACKING DATA USED FOR LONG-TERM SELENODESY

J. Lorell and P. A. Laing 1 Feb. 1970 241 p refs

(Contract NAS7-100)

(NASA-CR-109764; JPL-TM-33-419) Avail: CFSTI CSCL 03B

Tracking data from the five NASA lunar orbiters have been compressed into a set of normal points for use in studying the moon's gravity field. This report makes these normal points available in tabulated form and gives auxiliary information concerning the lunar orbiter mission and tracking patterns pertinent to the use of the normal points. Author

N70-27076*# Bellcomm, Inc., Washington, D.C.

MASCONS AS STRUCTURAL RELIEF ON A LUNAR MOHO

D. U. Wise (Massachusetts Univ.) and M. T. Yates 27 Jan. 1970 22 p refs

(Contract NASw-417)

(NASA-CR-109768; TR-70-340-2) Avail: CFSTI CSCL 03B

A mechanism for the creation of lunar mascons is proposed that requires no abnormal density materials nor density inversions. The mascons are produced by mantle plugs upwelling into giant impact basins punched through the lunar crust followed by volcanic filling of the remainder of the crater above the plug. It is explicitly shown that continued volcanic filling is not inhibited by the attainment of isostatic equilibrium. This model predicts a minimum crystal depth of 45 km in the Imbrium region, assuming a 0.5 gm/cu cm density contract between the lunar crest and mantle. The strength of the lunar mantle must be somewhat greater than the Earth's, however, this is not inconsistent with a composition essentially similar to the Earth's. The approximately linear relationship between the peak gravity anomaly and the mare basin diameter suggests that for craters less than 200 km diameter, the strength of the moon is sufficient to prohibit the formation of a mascon by mantle upwelling and volcanic filling. Author

N70-27084*# Analytical Mechanics Associates, Inc., Lanham, Md.

OPTIMUM SOLAR ELECTRIC INTERPLANETARY TRAJECTORY AND PERFORMANCE DATA

J. L. Horsewood and F. I. Mann Washington NASA Apr. 1970 480 p refs

(Contract NASw-1684)

(NASA-CR-1524) Avail: CFSTI CSCL 22C

A comprehensive collection of optimum trajectory and spacecraft design data for unmanned interplanetary missions using solar electric propulsion are presented for flyby and orbiter missions for Earth to Venus, Mars, Ceres, Jupiter, Saturn, Uranus, and Neptune and for flyby missions to Mercury. The planets are assumed to be in circular, coplanar orbits. For each mission, both direct and indirect flight modes are presented, and fully optimized trajectory data are given for missions using each of six launch vehicles. A constant jet exhaust speed solar electric propulsion system having a specific mass of 30 kg/kw is completely optimized in terms of power level and jet exhaust speed to yield maximum net spacecraft mass. The hyperbolic excess speeds at departure and arrival and the heliocentric travel angle are optimized for each mission. For orbiter missions, a chemical retro stage is used to brake the spacecraft into a highly eccentric capture orbit about the target plane. Author

N70-27116# Sintini (Amleto), Ravenna (Italy).

ASTRONOMY: UNIVERSE. REAL CAUSE OF EARTHQUAKES. ANTIMATTER. STRUCTURE OF LIGHT

Amleto Sintini May 1969 133 p In ITALIAN

Avail: CFSTI

The causes of earthquakes, deductions concerning the explorations of the universe, antimatter, the structure of light, and other topics are reviewed. Other subjects discussed include the sun and planets of the solar system, theory of relativity, and the principal constellations. Transl. by F.O.S.

N70-27134*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.

FREE-FALL PERIODIC ORBITS CONNECTING EARTH AND MARS

Charles Sherman Rall (Ph.D. Thesis) Oct. 1969 223 p refs

(Grant NGL-22-009-010)

(NASA-CR-10845; TE-34) Avail: CFSTI CSCL 22C

Free-fall periodic orbits which join Earth and Mars and which go back and forth between Earth and Mars forever are found through use of a patched conic analysis. Each of the periodic orbits found includes round trips from Earth to Mars and back to Earth along with series of direct returns at Earth. The periodic orbits are first established by computer solution in the case where the two planets are in circular coplanar orbits; then computer solution is attempted in the eccentric inclined case and has been found for several of the periodic orbit schemes attempted. In order to find these periodic orbits, a logical approach is developed to combine two round trips to Mars and two separate series of direct returns at Earth in an arrangement which is "symmetric" in time. The selection of the series of direct returns is facilitated by the formation of a list of all combinations of direct returns. The most efficient periodic orbit found requires four Earth-Mars synodic periods or 8.33 years on the average to make two round trips to Mars. Other periodic orbits found require five or more synodic periods to make the two visits to Mars. Author

N70-27148*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTIC CALCULATION OF LAUNCH VEHICLE RESPONSE TO WINDS AND CALCULATION OF OPTIMAL BIASED PITCH PROGRAMS
Janos Borsody Washington May 1970 39 p refs
(NASA-TN-D-5823; E-5590) Avail: CFSTI CSCL 22C

A simplified method is described for computing trajectory response of rocket vehicles to wind disturbances. It is useful in determining aerodynamic loading, launch availability, and thrust vector control system requirements. In the method presented, the equations of motion are linearized so they can be solved closed-form using certain simplifying assumptions. Closed-form equations are derived to determine angle of attack, flight attitude, and thrust deflection angle as functions of the wind disturbance. The analysis assumes a unity autopilot; however, any linearized autopilot model can be included. A method for obtaining optimum biased pitch and yaw programs using the simple linearized equations is also shown. Author

N70-27149# Minnesota Univ., Minneapolis.
PROPER MOTION SURVEY WITH FORTY-EIGHT INCH SCHMIDT TELESCOPE. PART 20: THE NORTH POLAR CAP, STATISTICAL DISCUSSION
Willem J. Luyten 31 Jul. 1969 12 p refs
(Grant NSF GP-8082)
Avail: Issuing Activity

Preliminary statistical discussions, including diagrams and tables, for the North Polar Cap Proper Motion Survey are presented. It is suggested that the North Polar Cap is representative for the whole sky. Analyses for stream motions, special objects, and secular parallaxes are also submitted. E.M.C.

N70-27150*# Stanford Univ., Calif. Dept. of Geology.
LUNAR ANALOGS OF FLUVIAL LANDSCAPES: POSSIBLE IMPLICATIONS, 1 MARCH 1968–1 FEBRUARY 1970
Arthur D. Howard and Ernest I. Rich 1 Feb. 1970 99 p refs
(Grant NGR-05-020-267)
(NASA-CR-109842) Avail: CFSTI CSCL 03B

Geomorphic approach to the problem of whether any features of the lunar landscape require fluid erosion is presented. The sculpturing of the lunar highlands suggests fluid erosion at an early stage in lunar history. The post-mare meandering rilles are sparsely distributed and largely confined to the lunar maria. Localized fluid erosion is also suggested by terrestrial-type valleys on the inner and outer flanks of both pre- and post-mare craters. Author

N70-27151*# Bellcomm, Inc., Washington, D.C.
INTAP: INTERPLANETARY TRAJECTORY ANALYSIS PROGRAM
R. W. Grutzner 26 Jan. 1970 152 p refs
(Contract NASw-417)
(NASA-CR-109777; TM-70-1032-2) Avail: CFSTI CSCL 22C

The computer program INTAP is intended as an aid in studying point-to-point, non-integrated, heliocentric conic section trajectories. It is not restricted to direct planet-to-planet flight but may include arbitrary points in a sequence of planets to be linked by conic section trajectories. The individual conics are generated as solutions to Lambert's problem and a set of constraint equations may be imposed upon a sequence of such conics, the most common constraint being a ballistic flyby of one or more planets in the sequence. The trajectories are computed at points within a two dimensional parameter grid, the constraint equations having reduced the number of degrees of freedom of the system to two, each of which is associated with an axis of the grid. Contour plotting is then utilized to generate level surfaces of the dependent variables. In addition to the trajectory characteristics, the information concerning near-planet encounters is computed using relative velocity vectors of approach and departure to determine the flyby orbits within the planetary sphere of influence. Author

N70-27169*# Computer Sciences Corp., Los Angeles, Calif. Systems Div.
THE EXPLORATION OF REALISTIC SHORT-ARC ORBIT PREDICTION AND SATELLITE ALTIMETER DATA UTILIZATION Final Report, 26 Jun. 1969–26 Apr. 1970
26 Apr. 1970 150 p
(Contract NASw-1918)
(NASA-CR-109826) Avail: CFSTI CSCL 22C

The precise location of the proposed GEOS-C satellite relative to the earth's surface is studied in short-arc orbits to determine the effectiveness of the radar altimeter mission. Error sources that affect satellite location are given as station-location errors, sensor errors, and force-model errors. Results indicate that the random radial error over short arcs with the GEOS-C being simultaneously tracked by three radars is a fraction of a meter. The short arc is defined as a ten-minute observational span of 1000 to 4000 km, for testing the consistency of the altimeter for detecting anomalistic depressions in sea level. F.O.S.

N70-27181*# Bellcomm, Inc., Washington, D.C.
LUNAR TRAJECTORY GEOMETRY
K. M. Carlson 23 Dec. 1969 99 p refs
(Contract NASw-417)
(NASA-CR-109834; TM-69-2011-3) Avail: CFSTI CSCL 22C

The principal features of earth-moon trajectories are analyzed using a geometric approach and patched conic trajectories. The influence of significant parameters is shown in a step by step manner until a comprehensive picture of earth-moon trajectories is created. In addition, a series of plots of the aimpoint on the moon's sphere of influence for various Keplerian elements of the trajectories is included. These plots, together with the analysis presented, provide the basis for a thorough understanding of the geometry of lunar trajectories. The techniques developed are used to illustrate some of the significant features of lunar landing missions and free return circumlunar trajectories. Author

N70-27218# National Lending Library for Science and Technology, Boston Spa (England).
UNRAVELLING THE MYSTERIES OF UNIVERSE
28 Nov. 1969 3 p
(NLL-M-7887-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Contributions to the understanding of solar phenomena resulting from manned space flight are briefly discussed with emphasis on the orbiting space laboratory aspects of the coordinated flight of Soyuz 3, 4, and 5. Space surveillance efforts from ground-based observatories are also mentioned. E.C.

N70-27254# Joint Publications Research Service, Washington, D.C.
REQUIREMENTS ON ACCURACY OF OPTICAL OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES FOR GEODETIC PURPOSES
Yu. V. Batrakov *In its* Bull. of Opt. Artificial Earth Satellite Tracking Sta. 11 Mar. 1970 p 10–21 refs (See N70-27252 13-13)
Avail: CFSTI

Direction errors from one station to another as a function of observation errors with synchronous optical observations from two stations was investigated. The direction error estimates are used to obtain the station coordinate errors. Requirements on accuracy of the optical observations are formulated. Author

N70-27263# Joint Publications Research Service, Washington, D.C.
VARIATE APPLICATION OF MULTIPLE FIXES IN ELEMENTARY COSMIC TRIANGULATION
B. A. Firago *In its* Bull. of Opt. Artificial Earth Satellite Tracking Sta. 11 Mar. 1970 p 109–115 refs (See N70-27252 13-13)
Avail: CFSTI

A synchronous straight line is used as the basic satellite triangulation element. Five different procedures are considered. A multiple fix solution is obtained. A number of conclusions are drawn regarding optimal triangulation. Author

N70-27264# Joint Publications Research Service, Washington, D.C.
APPLICATION OF THE VECTOR FORMULA OF A GREAT CIRCLE IN COSMIC TRIANGULATION
A. A. Kiselev *In its* Bull. of Opt. Artificial Earth Satellite Tracking Sta. 11 Mar. 1970 p 116–124 refs (See N70-27252 13-13)
Avail: CFSTI

Solutions to elementary problems of cosmic triangulation are presented. These problems include: (1) topocentric position determination of the satellite by the geocentric position; (2) geocentric position determination of the satellite by the topocentric position; (3) geocentric position determination of the observation station if the topocentric and geocentric positions of the satellite are known; (4) geocentric position determination of the satellite by a synchronous observation pair from two known stations; and (5) absolute direction determination of the chord connecting two stations using data of two pairs of synchronous satellite observations. The solution to all these problems is found by single-type scheme based on formula determining the unit vector of the point. Author

N70-27265# Joint Publications Research Service, Washington, D.C.
CONSTRUCTION OF COSMIC TRIANGULATION BY CHORD DIRECTIONS AND LENGTHS
B. M. Klentskiy *In its* Bull. of Opt. Artificial Earth Satellite Tracking Sta. 11 Mar. 1970 p 125–135 refs (See N70-27252 13-13)
Avail: CFSTI

The elementary figure permitting determination of the direction and length of the cosmic triangulation chord is investigated. A formula is presented for a priori evaluation of the chord length accuracy and recommendations are made regarding optimal size and shape of the figures. A procedure is proposed for correcting the investigated triangulation observations. Author

N70-27266# Joint Publications Research Service, Washington, D.C.
UTILIZATION OF OPTICAL OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES WITH TIME ERRORS IN COSMIC GEODESY
Yu. V. Batrakov *In its* Bull. of Opt. Artificial Earth Satellite Tracking Sta. 11 Mar. 1970 p 136–145 refs (See N70-27252 13-13)
Avail: CFSTI

Minimum number of stations and observed satellite positions required for determination of the mutual positions with simultaneous optical observations and time errors were studied. The required conditional equations are compared, and the calculations are performed using a ficticious example. Author

N70-27298*# Techtran Corp., Glen Burnie, Md.
ULTRAVIOLET ABSORPTION IN THE SPECTRA OF JUPITER [UL'TRAFIOLETOVOYE POGLOSHCHENIYE V SPEKTRAKH YUPITERA]
V. F. Kartashov Washington NASA Apr. 1970 7 p refs Transl. into ENGLISH from Tr. Astrofiz. Univ., Akad. Nauk Kazakhskoy (USSR), v. 9, 1967 p 47–50
(Contract NASw-1695)
(NASA-TT-F-12906) Avail: CFSTI CSCL 03B

The results of ultraviolet spectral observations of Jupiter in August 1965 are discussed. The spectrophotometric gradient of Jupiter was determined. The ultraviolet absorption in the spectra of these variations are discussed. Author

N70-27301*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EPHEMERIS OF A HIGHLY ECCENTRIC ORBIT: EXPLORER 28
Barbara E. Lowrey May 1970 29 p refs
(NASA-TM-X-63911; X-643-70-177) Avail: CFSTI CSCL 22C

An ephemeris has been obtained for Explorer 28 (IMP 3) which agrees well with 2 years of radio observations and with SAO observations a year later. This ephemeris is generated over the 3 year lifetime by a numerical integration method utilizing a set of initial conditions at launch and without requiring further differential correlation. Because highly eccentric orbits are difficult to compute with acceptable accuracy and because a long continuous arc has been obtained which compares with actual data to a known precision, this ephemeris may be used as a standard for computing highly eccentric orbits in the Earth-Moon system. Orbit improvement was used to obtain the initial conditions which generated the ephemeris. This improvement was based correcting the energy by adjusting the semimajor axis to match computed times of perigee passage with the observed. This procedure may generate errors in semimajor axis to compensate for model errors in the energy; however this compensation error is also implicit in orbit determination itself. Author

N70-27314*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RADAR STUDIES OF THE MOON Quarterly Progress Report
29 Jan. 1969 7 p
(Contract NAS9-7830)
(NASA-CR-108303; QPR-3) Avail: CFSTI CSCL 03B

The first few subarea maps have been produced from observations made in November 1968. This Planetary Radar Box was operated for four weeks from 28 October to 29 November, following the successful completion of the work on updating the receiver for two polarizations. For the present program, the subareas being mapped are ZAC areas, a more reasonable pseudo-range-doppler subdivision of the moon's surface, rather than the previous latitude-longitude subdivision into LAC areas. About 12 percent of the near hemisphere (30 out of 224 ZAC areas) was successfully measured with a resolution of at least 2.5 km. There were problems, however, with the post-processing computer programs that limited the number of finished maps to about six. The remaining measurements are being processed. Author

N70-27316*# Bellcomm. Inc., Washington, D.C.
SOLAR POINTING VARIATIONS IN EARTH ORBIT AND THE IMPACT ON MISSION DESIGN
B. D. Elrod 11 Feb. 1970 181 p refs
(Contract NASw-417)
(NASA-CR-109778; TR-70-620-1) Avail: CFSTI CSCL 22C

The solar vector orientation relative to an earth orbit varies with time due to the earth's motion about the sun and motion of the orbital plane due to earth oblateness. A detailed description of this variation is given in terms of two pointing angles: beta, the minimum angle between the solar vector and the orbital plane and psi, the location of orbital noon relative to the ascending node. Typical time variations are shown and various properties of the pointing angles are expressed as a function of orbital parameters for both posigrade and retrograde orbits. Specific results are included for 35 deg and 50 deg, 230 NM circular orbits, which have

been considered for AAP Workshop missions. Mission averages of system performance factors are relevant to mission planning and are developed in the report as a means of assessing the overall impact of the beta variation and arbitrary launch time and data. Author

N70-27318*# Techtran Corp., Glen Burnie, Md.
CARBONACEOUS MATTER IN METEORITIES (ORGANIC COMPOUNDS, DIAMONDS, GRAPHITE)
G. P. Vdovykin Washington NASA Apr. 1970 329 p refs Transl. into ENGLISH of the book "Uglerodistoye Veshchestvo Meteoritov (Organicheskiye Soyedineniya, Aomazy, Grafit)" Moscow, Nauka, 1967 p 5–240
(Contract NASw-1695)
(NASA-TT-F-582) Avail: CFSTI CSCL 03B

A generalization of the results of recent studies of the carbonaceous matter in meteorites (organic compounds, diamonds, and graphite) is synthesized. Their distribution, chemical composition, and structural characteristics are examined and the possible conditions for the formation of extraterrestrial matter and diamonds are discussed in relation to the origin of the meteorites containing them. Author

N70-27319*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE NATURE AND ORIGIN OF COMETS AND METEORS
S. K. Vsekhsvyatskiy Washington NASA Apr. 1970 183 p refs Transl. into ENGLISH of the book "Prioroda i Proiskhozhdeniye Komet i Meteornogo Veshchestva" Moscow, Rosveshcheniye, 1967 p 5–181
(Contract NASw-1692)
(NASA-TT-F-608) Avail: CFSTI CSCL 03B

The contemporary problems concerning comets, the characteristics of their movement, and their physical nature are discussed. Particular attention is given to the problems of the evolution and origination of comets. Proofs that comets are related to other groups of small bodies are presented in expanded form; justification of the disruption theory are given and important practical and theoretical results of modern cometary cosmogony are formulated. Author

N70-27383*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL AND TIDAL EFFECT ON THE ROTATION OF MERCURY
Han-Shou Liu Aug. 1969 10 p refs Submitted for publication
(NASA-TM-X-63893; X-643-69-402) Avail: CFSTI CSCL 03A

It is shown that the influences of the thermal and tidal effects on Mercury's libration are in equilibrium with the periods of rotation and revolution of Mercury locked in the 3:2 resonant state. The suggestion that the solar gravitational couple on the thermal bulges accelerates Mercury's rotation is investigated and the production of mechanical energy to balance the dissipation of the bodily tides is discussed. It is possible for Mercury to rotate with two bulges as a solar thermal engine; the tidal effect causes this engine to function and its maximum power is close to 1 gigajoule per second. Author

N70-27414# Royal Greenwich Observatory, Herstmonceux (England).
MOTION OF AO STARS PERPENDICULAR TO THE GALACTIC PLANE. PART 3: RADIAL VELOCITIES OBSERVED AT KOTTAMIA
Richard Woolley, A. S. Asaad, M. P. Candy, and Margaret J. Penston London Sci. Res. Council 1969 17 p refs Prepared jointly with Roy. Obs., Cape of Good Hope *Its* Roy. Obs. Bull. No. 156
Avail: CFSTI; Roy. Greenwich Obs., Herstmonceux Castle, Sussex: 5s

Observations of radial velocities of 64 stars classed as Ao in the Henry Draper Catalogue made with the Cassegrain spectrograph of the 74-inch telescope of the Helwan Observatory are described. These are analysed together with data from Wilson's General Catalog of stellar radial velocities and Wayman's observations in the South Galactic Cap. It is found that there is a significant increase in the velocity dispersion with height above the galactic plane. Comparison with the theory of Woolley and Stewart (1967) is satisfactory. Author (ESRO)

N70-27434# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
CONTRIBUTION TO THE FIRST EXTRA-TERRESTRIAL OBSERVATIONS OF THE MILKY WAY IN WINTER USING WIDE FIELD ULTRAVIOLET CAMERA [CONTRIBUTION AUX PREMIERES OBSERVATIONS EXTRA-ATMOSPHERIQUES A GRAND CHAMP DE LA VOIE LACTEE D'HIVER DANS L'ULTRAVIOLET]
Jean-Pierre Sivan (Ph.D. Thesis—Aix-Marseilles Univ.) 1970 81 p refs In FRENCH
Avail: CFSTI

The wide-field near-UV camera used for Veronique rocket observations of the Milky Way in winter is described. The photographs obtained are analysed and the calibration of the rocket and laboratory equipment is discussed in detail. ESRO

N70-27447 Centre de Documentation de l'Armement, Paris (France).
DETERMINATION OF THE TRAJECTORY OF A SPACE VEHICLE IN THE ABSENCE OF INFORMATION ON THE DISTRIBUTION FUNCTION OF THE MEASUREMENT ERRORS [DETERMINATION DE LA TRAJECTOIRE D'UN ENGIN SPATIAL EN L'ABSENCE D'INFORMATIONS SUR LA LOI DE REPARTITION DES ERREURS DE MESURE]
P. E. Eliasberg et al [1969] 22 p refs Transl. into FRENCH from Kosmich. Issled. (Moscow), v. 7, no. 1, 1969 p 18–27
Copyright. Avail: Issuing Activity

The problem of the optimal determination of the orbital parameters of a space vehicles in the absence of information on the distribution function of the measurement errors is considered, the worst relationships between the errors being assumed. The maximum probability method was applied to a wide class of distribution functions of some predetermined measurement errors and the solutions of this linear programmation problem, in a form which can be used to establish the calculation algorithm on a digital computer, were studied. Orbital parameters, such as distance and radial velocity, are treated as numerical examples. ESRO

N70-27454*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THREE-DIMENSIONAL LUNAR TRAJECTORIES
V. A. Egorov 1969 157 p refs Transl. into ENGLISH of the book "Prostranstvennaya Zadacha Dostizheniya Luny" Moscow, Nauka, 1965 149 p Sponsored by NASA and NSF *Its* Mech. of Space Flight
(NASA-TT-F-504; TT-68-50306) Copyright. Avail: CFSTI CSCL 22C

Various trajectories of reaching the moon are studied, with attention focused on finding energetically optimum trajectories which satisfy all the necessary conditions. A method is worked out for determining the optimum combinations of initial data, corresponding to the minimum energy expenditures. More accurate calculations are made of the nominal trajectories directed toward the center of the moon, taking into account the influence of the moon in its sphere of action, and of divergent trajectories whose initial data are close to nominal. The problem of determining the point of rocket impact on the moon is solved, and equations are formulated for the different characteristics of vehicle motion relative

to specified observation points. Results of trajectory calculations, and the effects of secondary factors are analyzed. An approximate technique is presented to determine (1) the moment of entry into the passive part of the trajectory to within about 5 minutes, (2) the initial velocity to within 1 m/sec in magnitude and 0.1 deg in direction, and (3) the direction of the rocket's radius vector at the end of flight to within about 1 deg. M.G.J.

N70-27456*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GODDARD ORBIT INFORMATION
J. W. Siry and D. J. Stewart Feb. 1969 11 p ref
(NASA-TM-X-63892; X-550-69-136) Avail: CFSTI CSCL 22C

A description is given of certain aspects of the preparation and presentation of orbit information, including the construction of an ephemeris on the basis of orbital arcs. Procedures used to specify orbital uncertainty estimate information are also described. Author

N70-27492# Arizona Univ., Tucson. Lunar and Planetary Lab.
RESEARCH DIRECTED TOWARD A PHOTO-TELESCOPIC SELENODETIC MEASURING PROGRAM Final Report, 1 May 1967 – 30 Sep. 1969
Gerard P. Kuiper, David W. G. Arthur, Harry J. Connors, and Patricia Bates 1 Dec. 1969 106 p refs
(Contract F19628-67-C-0240)
(AD-702526; AFCRL-69-0537) Avail: CFSTI CSCL 3/2

The report summarizes work done in the following areas: (1) Use selenodetic measures of star-trailed lunar photographs in a reduction with best available values of I and F to provide three-dimensional adjusted coordinates of not less than 45 lunar control points measured on 20 lunar photographic plates. (2) Continue the cartographic position program and provide measures of about 1000 control points on each of six additional selenodetic photographs. (3) Perform the necessary scientific work required to place the telescope in high performance condition for selenodetic research. The mirror was Kanogen coated, aluminized, and optical figuring completed. TAB

N70-27590*# McGill Univ., Montreal (Quebec). Space Research Inst.
REVIEW OF METEOROID-BUMPER INTERACTION STUDIES AT MC GILL UNIVERSITY
W. H. Friend, C. L. Murphy, and P. S. Gough Sep. 1969 144 p refs
(Contract NAS3-7946)
(NASA-CR-54858; SRI-R-25) Avail: CFSTI CSCL 03B

One of the theoretical models, the strip model, was developed to the stage wherein predictions of secondary surface loadings from actual meteoroid-bumper interactions can be made for a realistic space mission. The second theoretical approach, based on finite difference solutions to the fundamental relations governing the impact process, was restricted to a one-dimensional analysis of the processes involved in the region of the bumper and near the second surface. The experimental program covered a broad range of separate experiments, some to obtain experimental verification of assumptions made in the theoretical models, and others to obtain experimental data to be used as a basis for projection to the meteoroid regime. Specific areas investigated were bumper thickness effects, projectile shape effects, second surface pressure distribution for various impact conditions and bumper stand-off distances, shock Hugoniots for the impact materials utilized, shock decay data, secondary surface response, and a special study of the multiple skin or multifoil protection system. Author

N70-27638*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DISCUSSION OF HILL'S METHOD OF SECULAR PERTURBATIONS AND ITS APPLICATION TO THE DETERMINATION OF THE ZERO-RANK EFFECTS IN NON-SINGULAR VECTORIAL ELEMENTS OF A PLANETARY MOTION
Peter Musen Washington May 1970 27 p refs
(NASA-TN-D-5709) Avail: CFSTI CSCL 03A

Perturbations of zero-rank can cause large oscillations in both the shape and position of an orbit over a long time interval. Formulas are presented for the numerical integration of the zero-rank effects. Scaler elements are the two components of Hamilton's vector in a moving ideal reference frame, and the three components of Gibbs' rotation vector in an inertial system. The integration step can be several hundred years for a planet or comet, and a few days for a near-earth satellite. Vectorial analysis is applied in a pseudo-Euclidian space to obtain a symmetrical computational scheme in terms of traces of dyadics in the space. The method is inapplicable for two orbits very close together. The numerical difficulty appears as a small divisor in Hill's method; as a slow convergence of a hypergeometric series in Halphen's method. Thus, in Hill's method the difficulty can be watched more directly than in Halphen's method. Numerical averaging can treat a large range of orbital eccentricities and inclinations; it can treat both the free and forced secular oscillations, and together with their mutual cross-effects. Author

N70-27696# Princeton Univ., N.J.
MODELS OF THE ATMOSPHERE OF JUPITER
B. D. Savage and R. E. Danielson [1969] 34 p refs
(Proj. Stratoscope)
Avail: CFSTI

Earlier low resolution infrared spectra of Jupiter showed a discrepancy in the abundance of NH3 estimated to be present in the Jovian atmosphere and the abundance recorded by observations. Simple Jovian model atmospheres are constructed in order to explore the discrepancy and to obtain more information about the structure of Jupiter's atmosphere. The models are based on the assumption that the opacity in the far infrared is primarily due to collision-induced rotational and translational transitions in H2. R.B.

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N70-26751*# Terra-Space Corp., Malibu, Calif.
THE SOVIET INTERPLANETARY STATION VENUS-4
[1969] 18 p Transl. into ENGLISH from Pravda (Moscow), 22 Oct. 1967 p 6 Prepared for JPL
(Contract NAS7-100)
(NASA-CR-109721; TSC-WA-1100) Avail: CFSTI CSCL 22B

Pertinent data concerning the automatic interplanetary station Venus-4 and its descent on the planet Venus are presented. Descriptions are given of the spacecraft's systems including the orbital section, landing capsule, radio complex, power supply system, orientation and stabilization system, and the thermo-regulation system. The flight of Venus-4 is discussed and schematics are presented illustrating the flight trajectory, principle stages of the flight, and the soft landing of the landing capsule. In addition, the scientific investigations conducted by the station are described and the significance of the data obtained from these experiments is discussed. D.L.G.

N70-27020*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AN ANALYSIS OF POTENTIAL SPACE SHUTTLE CARGO-HANDLING MODES OF OPERATION
Walter E. Whitacre 27 Feb. 1970 67 p refs
(NASA-TM-X-64507) Avail: CFSTI CSCL 22A

The current status of Space Shuttle cargo-handling analysis is reported. The problems involved in orbital docking, payload extraction and transfer, cargo handling, and special purpose missions are discussed and some tentative conclusions and recommendations are presented. Author

N70-27142*# General Dynamics/Convair, San Diego, Calif. Research and Engineering Dept.
EVALUATION AND APPLICATION OF DATA FROM LOW-GRAVITY ORBITAL EXPERIMENT, PHASE 1 Final Report
R. D. Bradshaw 1 Apr. 1970 252 p refs
(Contract NAS8-21291)
(NASA-CR-109847; GDC-DDB-70-003) Avail: CFSTI CSCL 22A

Results are reported of a study to analyze the S-IVB-AS-203 data and other available data to determine the applicability and adequacy of analytical models in several areas of thermodynamics and fluid mechanics. In particular, areas considered were repressurization, vehicle heating, pressure rise, liquid level phenomena during venting, boiling and propellant sloshing. Analytical models were developed and models were verified in each of these areas. Areas requiring further study are identified. Author

N70-27232*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
PRELIMINARY FEASIBILITY STUDY OF SOFT-LANDER MISSIONS TO THE GALILEAN SATELLITES OF JUPITER
M. J. Price and D. J. Spadoni Jan. 1970 38 p refs
(Contract NASw-1837)
(NASA-CR-109770; M-19) Avail: CFSTI CSCL 22A

A preliminary study was made of the scientific objectives and technical feasibility of soft-landing spacecraft of 1000 lbs. useful payload on each of the Galilean satellites of Jupiter. For trajectory and payload analysis, the mission was separated into four distinct phases, and various propulsion/propellant system combinations were studied. The breakdown was: (1) launch and earth-escape, using chemical, chemical-nuclear, or chemical-nuclear-electric propulsion; (2) interplanetary trajectory, using either ballistic or low thrust propulsion; (3) satellite capture maneuver using chemical, cryogenic, or nuclear rocket propulsion; and (4) terminal descent maneuver using variable thrust chemical propulsion. Results indicate that missions to Callisto are possible using as the launch vehicle either the SIC/SIVB/Centaur or the Titan 3F/Solar-Electric systems, together with a space-storable chemical retro-maneuver for satellite capture. All four satellites become accessible with a Titan 3F-Nuclear Electric launch vehicle and a solid chemical retro-maneuver. Author

N70-27272# Joint Publications Research Service, Washington, D.C.
INHABITED ORBTAL STATIONS
V. Volkov 13 May 1970 9 p Transl. into ENGLISH from Sots. Industriya (Moscow), 12 Apr. 1970 p 4
(JPRS-50511) Avail: CFSTI

The use of manned orbital laboratories is proposed for monitoring natural resources and weather forecasting. R.B.

N70-27351*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ATLAS-CENTAUR AC-16 FLIGHT PERFORMANCE EVALUATION FOR THE ORBITING ASTRONOMICAL OBSERVATORY OAO-2 MISSION
Washington May 1970 157 p refs
(NASA-TM-X-1989; E-5306) Avail: CFSTI CSCL 22D

The Atlas Centaur 16 vehicle successfully launched the OAO into a nearly circular earth orbit at an altitude of 772 km using a direct (single burn) mode of ascent. This report discusses the flight performance of the AC-16 launch vehicle from liftoff through the Centaur retromaneuver after spacecraft separation. Author

N70-27633# Entwicklungsring Nord, Bremen (West Germany).
INVESTIGATION ON POSSIBLE PAYLOADS FOR EUROPA 2 ON THE COS-B SATELLITE ORBIT [UNTERSUCHUNG DER MOEGLICHEN NUTZLASTEN VON EUROPA 2 FUER DIE FLUGBAHN DES COS-B-SATELLITEN]
Feb. 1970 147 p refs In GERMAN; ENGLISH summary *Its* ELDO Study No. 9.4
(Contract ELDO-CTR-17/4/22)
Avail: CFSTI

It is planned to use the ELDO Europa 2 launch vehicle for the ESRO Cosmic Ray Satellite-B mission (COS-B). The launch vehicle required to inject a 260 kg satellite into an eccentric orbit with a perigee of about 350 km and an apogee of about 100,000 km, the apogee being located above the North Pole at the highest possible northern latitude. In order to check whether these requirements could be met by the Europa 2 launcher, a parameter analysis was performed to define an optimum ascent program. The pitch program of the first stage was analysed incorporating certain restrictions such as wind loads and aerodynamic heating and other ascent techniques utilizing circular and elliptical parking orbits were investigated. The calculations showed that the maximum payload can be placed in the final orbit by using an elliptical parking orbit. Author (ESRO)

N70-27651*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STUDY OF SYSTEMS AND COST/PERFORMANCE METHODOLOGIES FOR OPTIMIZATION OF VEHICLE ASSIGNMENT. VOLUME 1: TECHNICAL DESCRIPTION Final Report
8 May 1970 56 p refs
(Contract NAS2-5202)
(NASA-CR-73434-1) Avail: CFSTI CSCL 22D

Analysis is performed and computer programs developed for optimal assignment of expendable and reusable launch vehicles in a multi-year, multi-mission space program. A primary objective is provision of an analytical tool to help the advance planner to maximize, under restrictive budget constraints, the accomplishment of a future space program. Such a program will normally include existing vehicles, growth versions, and new starts. Explicit handling of all contributing and interrelated costs (recurring, nonrecurring, and sustaining) ensures global solution for a previously intractable problem. The programs analyze the multiple factors that apply, including stage and vehicle characteristics, mission requirements, production aspects, launch sites and pads, sustaining effort, and others. A single computer run identifies stages and vehicles that comprise the optimum launch vehicle family and provides an array of data pertinent to this optimum. An integrated vehicle assignment and budget smoothing feature provides for optimal accomplishment of a space program without exceeding yearly budget constraints. See also N70-27652 and N70-27653. Author

N70-27652*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STUDY OF SYSTEMS AND COST/PERFORMANCE METHODOLOGIES FOR OPTIMIZATION OF VEHICLE ASSIGNMENT. VOLUME 2: PROGRAMMER'S MANUAL FOR VEHICLE ASSIGNMENT MACHINE MODEL Final Report
8 May 1970 91 p
(Contract NAS2-5202)
(NASA-CR-73434-2) Avail: CFSTI CSCL 22D

Model input requirements, a sample case, flow charts, and a program listing are provided. Descriptive details and technical comments are given to indicate any special instructions for using

the data. The program listing includes comment cards that state the purpose of each subroutine in the complete program and that describe operations performed within the subroutine. See also N70-27651 and N70-27653. Author

N70-27653*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STUDY OF SYSTEMS AND COST/PERFORMANCE METHODOLOGIES FOR OPTIMIZATION OF VEHICLE ASSIGNMENT. VOLUME 3: PROGRAMMER'S MANUAL FOR INTEGRATED BUDGET SMOOTHING AND VEHICLE ASSIGNMENT MACHINE MODEL Final Report
8 May 1970 133 p
(Contract NAS2-5202)
(NASA-CR-73434-3) Avail: CFSTI CSCL 22D
For abstract see N70-27652. See also N70-27651.

N70-27668*# Boeing Co., Seattle, Wash. Space Div.
SATURN 5 SINGLE LAUNCH SPACE STATION AND OBSERVATION FACILITY. COMBINED MISSION CONCEPT EVALUATION Final Report
Nov. 1967 146 p
(Contract NAS9-6816)
(NASA-CR-109775; 02-114014-1) Avail: CFSTI CSCL 22B
The possibility and practicality of a combined mission in Earth orbit to develop a significant segment of a Mars mission spacecraft while conducting an Earth orbital experiment program were investigated. The results of the experiment capability, contribution of the combined mission, crew utilization, reliability, and maintenance analyses are summarized. An eight-man crew configuration was selected which provides a capability program and simulation of critical flyby operations. The selected configuration provides the equivalent of two development missions in testing on the EC/LS and crew systems with a 99 percent probability of successful operation for two years. Author

N70-27678# Boelkow G.m.b.H., Ottobrunn bei Muenchen (West Germany).
THE SIMULATION OF EUROPA 1 LAUNCH VEHICLE [DIE SIMULATION DER TRAEGERRAKETE EUROPA 1]
H. Bittner *In* DVFLR Symp. on Hybrid Computers in Aeron. and Astronaut., Pt. 2 May 1969 p 47–63 In GERMAN (See N70-27676 13-08)
(RS-24-0) Avail: CFSTI; Zentralstelle fuer Luftfahrtdokumentation und Inform. (ZLDI), Munich: 46,90 DM
The total simulation of the third stage of the Europa 1 launch vehicle, using a prototype model and a large hybrid computer, is described. The autopilot loop and the thrust vector control loop are simulated leading to explicit, implicit, and optimal control. The digital or Kalman filtering of data transmitted from the launch vehicle during flight is discussed. ESRO

N70-27712*# Fairchild Hiller Corp., Germantown, Md. Space and Electronics System Div.
DEVELOPMENT OF THE SERT-2 SPACECRAFT SUPPORT UNIT Summary Report
30 Apr. 1970 201 p
(Contract NAS3-9716)
(NASA-CR-72466; SERT-069-074) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740
The design and development of the spacecraft support unit (SSU) for the SERT II, a spacecraft used to test electron bombardment ion engines are described. The SSU contained two telemetry transmitters, two command systems and two tape recorders for data storage along with the power distribution system, a battery for reacquisition control and four control moment gyros to help stabilize the spacecraft. Author

N70-27718# Entwicklungsring Nord, Bremen (West Germany).
FEASIBILITY STUDY OF AN AERODYNAMIC RE-ENTRY BODY [DURCHFUEHRBARKEITSSTUDIE ZU EINEM AERODYNAMISCHEN WIEDEREINTRITTSKOERPER]
E. Overesch Jan. 1970 72 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-70-02) Avail: CFSTI
Before proposing a European program concerning aerodynamically controlled re-entry, an extensive experimental program with flight tests will be necessary. A feasibility study was carried out on the basis of a re-entry body configuration recently developed by ERNO, to determine the necessary theoretical and experimental work for an unmanned trial of an aerodynamically controlled re-entry vehicle. The weight and size of such a flight vehicle were estimated and a time schedule for development, management structures, and costs were investigated. Author (ESRO)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N70-26568*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A FINITE ELEMENT APPROACH TO THE STRUCTURAL INSTABILITY OF BEAM COLUMNS, FRAMES, AND ARCHES
Jerrell M. Thomas Washington May 1970 55 p refs
(NASA-TN-D-5782; M-351) Avail: CFSTI CSCL 20K
A nonlinear stiffness matrix for a beam column element subjected to nodal forces and to a uniformly distributed load is developed from the principle of virtual displacements and the bifurcation theory of elastic stability. Three cases of applied load behavior are considered. The buckling load of a uniform circular arch is calculated as an example. Author

N70-26695# Akademiya Nauk URSR, Kiev.
LONGITUDINAL VIBRATIONS OF THE DRILL COLUMN AND DRILLING TOWER DUE TO VIBRATIONS OF THE BIT
S. G. Kalinin *In its* Appl. Acoustics and Vibration Technol. 1968 p 136–142 refs In RUSSIAN (See N70-26676 13-34)
Avail: CFSTI
In order to select an efficient design for devices to dampen elastic vibrations, it is necessary to determine the frequencies and amplitudes of the longitudinal vibrations at various lengths of the drilling column. An equation is derived and functions are obtained for determining the amplitudes of the longitudinal vibrations of a three-stage drilling column, tackle cable, and drilling tower, caused by vertical vibrations of the drill bit. The following factors are taken into account for deriving the functions: the viscous resistance of the borehold, the mass of the movable part of the tackle system, the rigidity and mass of the tackle cable, the mass of the crown block, and the rigidity and mass of the drilling tower. Transl. by H.W.

N70-26784# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.
FURTHER STUDIES OF AN INELASTIC BEAM-COLUMN PROBLEM
W. F. Chen Jan. 1970 69 p refs
(Contract N00024-69-C-5381)
(AD-701769; FEL-331.6; NAVSHIPS-0911-000-9010) Avail: CFSTI CSCL 13/13

Previous work on the solution of an eccentrically loaded beam-column under a concentrated load at the mid-span is extended. Expressions are first derived for the moment expressed explicitly in terms of curvature and thrust for various shapes of structural sections with or without the influence of residual stress. Using these results, interaction curves relating axial thrust, lateral load, and slenderness ratio with various values of end eccentricities are presented for the maximum load carrying capacity of the beam-columns. An approximate solution of the beam-column problem is then treated. Useful expressions for the interaction curves are obtained. Author (TAB)

N70-26849# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INVESTIGATION OF STRESSES IN A COMPRESSOR-BLADE FOIL
V. B. Gorlov 22 Aug. 1969 8 p refs Transl. into ENGLISH from Vsesoyuznaya Konf. po Polyarizatsionno-Optich. Metodu Issled. Napryazh. (Leningrad), 1964 p 330–334
(AD700595; FTD-HT-23-152-68) Avail: CFSTI CSCL 13/7

The paper contains the results of an investigation of stresses in compressor rotors and blades. Specifically, the stresses in dove-tail joints (two-dimensional problem) and the key end of a compressor blade with a considerable natural twist (three-dimensional problem) were evaluated. A model of the rotor was constructed using a special alloy. The stresses between the blade slots on the rotor were measured using an optical polarization method. A grid was applied to the blade at the beginning of the experiment. The distortion of the grid pattern after the test was used to measure the strain. The effects of rotor and joint geometries on the stress distribution were measured and plotted. TAB

N70-26873# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN APPROXIMATE METHOD FOR DETERMINING STRESSES IN AN ELASTIC ANISOTROPIC PLATE NEAR AN OPENING WHICH IS ALMOST CIRCULAR
S. G. Lekhnitskii 8 Sep. 1969 40 p refs Transl. into ENGLISH from Inzh. Sb. (USSR), v. 17, 1953 p 3–28
(AD-699664; FTD-HT-23-367-69) Avail: CFSTI CSCL 13/13

An approximate method is suggested for solving the two-dimensional problem of the theory of elasticity of an infinite, anisotropic plate with an almost circular opening. The method is based on the introduction of a small parameter characterizing the deviation of the opening from the circular. The problem is reduced to the problem of the equilibrium of an anisotropic plate with a circular opening. Chief attention is given to an opening having four axes of symmetry. Approximate solutions for a plate with such an opening are derived for both the general case of loading and for two particular cases when the plate is orthotropic and is deformed by: (1) tensile stresses and (2) bending moments. Author (TAB)

N70-26882# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
STATIC ANALYSIS OF SHELLS OF REVOLUTION USING DOUBLY-CURVED QUADRILATERAL ELEMENTS DEPRIVED FROM ALTERNATE VARIATIONAL MODELS
Satyanadham Atluri Jun. 1969 291 p refs
(Contract F04694-67-C-0039)
(AD-701084; ASRL-TR-146-7; SAMSO-TR-69-394) Avail: CFSTI CSCL 20/11

A systematic classification of the variational functionals whose stationary conditions (Euler equations) can be used alternately to solve for the various unknowns in a boundary value problem in linear shell theory is made. The application of these alternate variational principles to a finite-element assembly and thus the development of the properties of the individual discrete element are studied. Two models are developed in detail; one is a Compatible-Displacement Model in which an element interior displacement field that generates compatible interelement boundary displacements is assumed, but no rigid body displacement modes are included in the element displacement field; and the other is a Hybrid-Displacement Model in which rigid body modes are included explicitly in the displacement field in the interior of the element and a Lagrangian multiplier technique is used to satisfy the interelement boundary displacement compatibility on the average, but rigid body displacement modes are not included at the element boundaries. The geometrical shape of the finite element in both of the models is a doubly-curved quadrilateral element whose edge curves are the lines-of-curvature coordinates employed to define the shell midsurface. Author (TAB)

N70-26951# Brown Univ., Providence, R.I. Div. of Engineering.
A CURVED FINITE ELEMENT FOR THIN ELASTIC SHELLS Technical Report
George Dupuis and Jean-Jacques Goel Dec. 1969 35 p refs
(Contract N00014-67-A-0191-0007)
(AD-701325; TR-4) Avail: CFSTI CSCL 13/13

The paper is concerned with a curved triangular finite shell element, which represents the rigid-body motions exactly and assures convergence in energy. The stiffness matrix is derived in a general way that is valid for all mathematical models which accept Kirchhoff's assumption. A numerical example is presented to indicate the quality of results that can be obtained with 9 or 18 degrees of freedom at each meshpoint and basic functions of classes C1 or C2. Author (TAB)

N70-26989# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ON THE BENDING OF CRACKED PLATES Technical Report, Feb. – Aug. 1969
Charles Sve and L. M. Keer (Northwestern Univ.) 28 Dec. 1969 35 p refs Prepared in cooperation with Northwestern Univ.
(Contract F04701-69-C-0066)
(AD-701740; TR-0066(5240-30)-4; SAMSO-TR-70-34) Avail: CFSTI CSCL 13/13

An analysis that predicts the deflections of cracked plates is presented. Each problem is formulated in terms of dual series equations and reduced by standard techniques to a Fredholm integral equation that is solved numerically. Three cases are considered: two external cracks, crack in center of plate, and one external crack. Numerical results are included for the strain energy and the stress intensity factor. Comparison of results demonstrates the importance of geometry to these problems. Author (TAB)

N70-26999*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INSTABILITY OF SLENDER THIN-WALLED BOOMS DUE TO THERMALLY INDUCED BENDING MOMENTS
Vernon K. Merrick Washington May 1970 63 p refs
(NASA-TN-D-5774; A-3284) Avail: CFSTI CSCL 20K

The stability of slender thin-walled booms illuminated by thermal radiation is investigated. The problem is simplified by the assumptions that the cross section is thermally (but not necessarily structurally) seamless and thermal torques are negligible. This report is therefore a treatment of the influence of thermally induced bending moments on boom stability. The linearized analysis developed shows that in the absence of structural damping, any initially straight boom, with either a seamless or open cross section, is unstable. The instability is an oscillatory divergence and is particularly severe for booms of open cross section. Stability can be attained by the use of flexural damping, but in many cases the amount required is greater than can be provided by the structure alone. Torsional damping is relatively ineffective. A damper, in the form of a closed vessel, rigidly attached to the boom tip, and containing a ball free to move through a viscous fluid, is an effective stabilizer for a large class of booms important in space applications. Author

N70-27017# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
FATIGUE MECHANISMS, FATIGUE PERFORMANCE AND STRUCTURAL INTEGRITY Final Report, Mar. 1963–Sep. 1969
A. M. Freudenthal Dec. 1969 36 p refs
(Contract Nonr-266(91))
(AD-701415) Avail: CFSTI CSCL 13/13

The work of the Institute was concentrated in three principal areas: Metal physics and micromechanisms of fatigue; experimental and theoretical solid mechanics; experimental and theoretical structural integrity and reliability. The principal accomplishments of research workers of the Institute in these three areas are outlined. Author (TAB)

N70-27046# Sandia Corp., Albuquerque, N.Mex.
TERRADYNAMIC RESULTS AND STRUCTURAL PERFORMANCE OF A 650-POUND PENETRATOR IMPACTING AT 2570 FEET PER SECOND
W. J. Patterson Dec. 1969 29 p refs
(SC-DR-69-782) Avail: CFSTI

An Apache rocket motor/penetrator system for high-velocity earth penetration tests is described. During the most recent test, the system was released from an F-4D aircraft in a vertical dive 25,640 feet above the target (31,000 feet MSL) at a velocity of 1290 fps. Nine seconds after release from the aircraft, the Apache rocket motor was ignited, boosting the penetrator to 2570 fps at impact. The penetrator achieved a vertical depth of 187.5 feet and penetrated 196 feet along a slant path. There was no significant structural damage to the vehicle. Author

N70-27047*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRACTURE OF THIN SECTIONS CONTAINING THROUGH AND PART-THROUGH CRACKS
Thomas W. Orange, Timothy L. Sullivan, and Frederick D. Calfe [1970] 30 p refs
(NASA-TM-X-52794; E-5657) Avail: CFSTI CSCL 20K

Current fracture mechanics theory is used to illustrate the effects of crack dimensions and material properties on fracture stresses for through-thickness and part-through cracks. The implications of the analysis for leak-before-burst design of pressure vessels are discussed. The fracture tests indicate that when the Irwin plastic zone size is less than about one-tenth of the uncracked ligament depth (thickness minus crack depth), surface-crack fracture behavior is in agreement with plane-strain theory. When the plastic zone is greater than the ligament depth, fracture stresses for surface-crack specimens are very nearly the same as for specimens with through-cracks of the same original length. Author

N70-27056*# City Coll. of the City of New York. Dept. of Civil Engineering.
LINEAR AND NONLINEAR RESPONSE OF A RECTANGULAR PLATE SUBJECTED TO LATERAL AND INPLANE SONIC BOOM DISTURBANCES
Lawrence J. Knapp and David H. Cheng Apr. 1970 84 p refs
(Grant NGR-33-013-039)
(NASA-CR-66936; Rept-7) Avail: CFSTI CSCL 20K

The transient response of a rectangular window pane exposed to a far-field sonic boom disturbance is studied with the help of both the linear and nonlinear theories. The sonic boom disturbance causes a lateral disturbance in the form of an N-shaped pressure pulse and an inplane disturbance in the form of a sinusoidal pulse. In the linear theory, the imposition of lateral and inplane pulses may be simultaneous or separated by a brief time-delay. The effects of the inplane static and dynamic loads, the pulse durations, and the time-lag are studied. In the nonlinear theory, in addition to the usual simply supported boundary conditions, two sets of inplane boundary conditions are specified: movable vertical sides and immovable vertical sides. The effects of the dynamic inplane load, the lateral overpressure, and the movable and immovable vertical sides are studied. The results obtained by the linear and nonlinear theories are compared. Author

N70-27059# California Univ., San Diego. Dept. of the Aerospace and Mechnical Engineering Sciences.
A CONSISTENT NUMERICAL METHOD FOR THE SOLUTION OF NONLINEAR ELASTICITY PROBLEMS AT FINITE STRAINS Technical Report
S. Nemat-Nasser and H. D. Shatoff Oct. 1970 53 p refs
(Contract N00014-69-A-0200-6007)
(AD-701332; TR-2) Avail: CFSTI CSCL 20/11

Based on an absolute minimum principle for small deformations superimposed on a finitely deformed, stable configuration of an elastic solid, a consistent numerical method is developed for a step-by-step incremental solution of large deformation problems which include material as well as geometric nonlinearities (finite rotations and strains). The Lagrangian and Eulerian formulations are presented and compared. Piecewise linear displacement fields are considered, where tetrahedral elements of arbitrary dimensions for the three-dimensional problems, and triangular elements for the plane strain problems are used. Both compressible and incompressible elastic materials are considered, and explicit results are given. Two numerical examples are worked out in detail to illustrate the results. Finally, the incremental method is combined with an iterative scheme, whence an effective method which provides more accurate results with less computational efforts is obtained. Author (TAB)

N70-27064# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATIONS FOR STRENGTH AND OSCILLATIONS IN ROCKET ENGINES
A. F. Gurov 6 Nov. 1969 498 p refs Transl. into ENGLISH from the Russian
(AD-701237; FTD-MT-24-276-69) Avail: CFSTI CSCL 21/8

In the book are expounded methods of calculation for strength and oscillations of components and subassemblies of rocket engines. In particular, there are considered strength and oscillations of turbine blades of turbopump unit, strength of turbopump unit turbine disks, allowable stresses and safety factors for these elements of the engine. Calculations are listed on the strength of housing shells of engine and combustion chambers. There are examined associated oscillations of various complex systems, critical speed of rotation of shafts damping of oscillations and shock absorption. Author (TAB)

N70-27080# American Univ., Beirut (Lebanon). Dept. of Mathematics.
PAPKOVITCH FUNCTIONS IN PROBLEMS OF ELASTICITY Final Scientific Report, 1 Jan. 1965–30 Jun. 1968
Wasfi A. Hijab 25 Dec. 1969 5 p refs
(Contract AF 61(052)-849)
(AD-701418; AFOSR-70-0312TR) Avail: CFSTI CSCL 20/11

The solutions of two three-dimensional problems of a concentrated force at an interior point in quarter-space with mixed boundary conditions, zero normal displacement and zero shearing stresses, on one half-plane and with a free or fixed second half-plane are given. The solutions express the boundary conditions in terms of Papkovitch functions and use Greens analysis to evaluate these functions. Author (TAB)

N70-27115*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.
APPLICATION OF STRUCTURAL ANALYSIS AND MATRIX INTERPRETIVE SYSTEM
R. M. Bamford 15 Mar. 1970 28 p refs
(Contract NAS7-100)

(NASA-CR-109728; JPL-TM-33-399-Rev-1) Avail: CFSTI CSCL 20K

The matrix manipulations required for common structural analysis problems are developed, the control cards that direct the structural analysis and matrix interpretive system to perform these operations are listed, the required data are described, and a sample problem is given. Author

N70-27122# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
EXPERIMENTAL AND THEORETICAL DETERMINATION OF RESIDUAL STRESSES IN FILAMENT-WOUND RINGS
B. R. Dewey and C. E. Knight, Jr. 6 Jan. 1970 45 p refs
(Contract W-7405-eng-26)
(Y-1701) Avail: CFSTI

Analytical and experimental techniques have been developed and evaluated for determining residual stresses in filament-wound rings. Extension to more complex geometries appears obvious but was not investigated. These techniques should provide the tools for optimizing structural performance in filament-wound composites. All techniques proved to be useful and differed only in the accuracy of results (least accurate within ten percent; most accurate within one percent). Radial variation of material properties was accounted for in a stepwise fashion in the most accurate technique. Author

N70-27128*# Astro Research Corp., Santa Barbara, Calif.
AXISYMMETRIC FILAMENTARY STRUCTURES
A. F. Fraser, P. R. Preiswerk, M. D. Benton, and O. R. Burggraf Washington NASA Apr. 1970 113 p refs
(Contract NAS7-427)
(NASA-CR-1518; ARC-R-274) Avail: CFSTI CSCL 20K

The theory of filamentary axisymmetric structures is broadened to include surface loads other than normal pressure. Structures with two sets of symmetrically disposed fiber are considered in detail, and force transfer between filaments is accounted for in the theory. The governing equations are derived, and isotensoid surface shapes are determined and classified for a wide range of load conditions. The governing equations are also applied to problems where the surface shape and loading are prescribed and the filament geometry and load variation in the surface are to be determined. The general nature of filamentary structures is discussed in depth, and useful qualitative results are obtained for multiple layer nets. A non-axisymmetric isotensoid (or isocompressoid) is obtained as a special limiting case. Author

N70-27129*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
FOUNDATIONS OF AEROELASTIC OPTIMIZATION AND SOME APPLICATIONS TO CONTINUOUS SYSTEMS
Jean-Louis Armand and William J. Vitte Jan. 1970 88 p refs
(Grant NGL-05-020-243; Contract F44620-68-C-0036)
(NASA-CR-66939; AFOSR-70-0450TR; SUDAAR-390) Avail: CFSTI CSCL 20K

Various optimization problems are presented with applications of the general methods developed in optimum control theory and based on the Hamiltonian formulation of variational calculus for structural optimization with aeroelastic constraints. Static and dynamic aeroelastic problems (more precisely flutter problems) are reviewed. Author

N70-27133*# Barry Controls, Inc., Watertown, Mass.
RESPONSE AND OPTIMIZATION OF AN ISOLATION SYSTEM WITH RELAXATION TYPE DAMPING
Thomas F. Derby and Peter C. Calcaterra Washington NASA May 1970 135 p refs
(Contract NAS1-8465)
(NASA-CR-1542) Avail: CFSTI CSCL 20K

The effect damping has on the free vibration, impulse, random vibration, and shock pulse response of mechanical isolation systems which incorporate elastically coupled damping elements is reported. The response quantities considered are the acceleration of the mass and the deflection of the isolator, with the acceleration of the base as the input. Author

N70-27205# Sandia Corp., Albuquerque, N.Mex.
DYNAMIC RESPONSE OF CORE-FILLED CYLINDERS
Peter H. Prasthofer Jan. 1970 18 p refs
(SC-DR-69-870) Avail: CFSTI

An uncoupled solution is presented for stresses in a core-filled cylindrical shell subjected to impulsive loading, considering both viscoelastic membrane stresses, as well as elastic bending stresses, and neglecting shell transverse shear, rotary inertia, and core mass. A truncated approximate solution is also discussed. Author

N70-27293*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATIC AND DYNAMIC FATIGUE BEHAVIOR OF GLASS FILAMENT-WOUND PRESSURE VESSELS AT AMBIENT AND CYROGENIC TEMPERATURES
Morgan P. Hanson Washington May 1970 refs
(NASA-TN-D-5807) Avail: CFSTI CSCL 20K

Scale-model pressure vessels in the form of right circular cylinders were investigated under static and cyclic loading in ambient and liquid nitrogen environments. Tests were performed at various percents of the single-cycle burst strength to establish fatigue behavior. Liner concepts using a polyimide film, aluminum foil, and electro-formed aluminum were investigated. Comparisons were made of the static and dynamic fatigue life of cylinders in ambient and liquid nitrogen environments. Author

N70-27345# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugzeugbau.
THE DETERMINATION OF THE FATIGUE LIFE OF HELICOPTER COMPONENTS [DIE ERMITTLUNG DER LEBENSDAUER VON HUBSCHRAUBERBAUTEILEN]
Rudolf Prinz Dec. 1969 74 p refs In GERMAN; ENGLISH summary Presented at the DGLR meeting on Rotating Wing Aircraft and Propellers, Immenstadt, West Ger., 24 Jun. 1969
(DLR-MITT-69-26) Avail: CFSTI

The methods available for the determination of the fatigue life of helicopter components, based on the determination of the performance fatigue stress, are discussed. Calculated and measured stress-time functions are considered, and the analytical and experimental procedures for their statistical computation are reviewed. The application of a standard distribution program for fatigue tests based on the different ones noted in literature is proposed. Some possible fatigue tests are suggested and the necessity of statistical evaluation of the test results is stressed. Some procedures for the determination of fatigue life, using the scattering stresses, are presented. Author (ESRO)

N70-27421*# Scientific Translation Service, Santa Barbara, Calif.
HARMONIC VIBRATION TESTING OF A NON-LINEAR AIRCRAFT STRUCTURE [L'ESSAI DE VIBRATION HARMONIQUE D'UNE STRUCTURE D'AVION NON-LINEAIRE]
C. Beatrix Washington NASA May 1970 7 p refs Transl. into ENGLISH from Rech. Aerospatiale (French), no. 132, Sep.–Oct. 1969 p 58–59
(Contract NASw-2035)
(NASA-TT-F-13035) Avail: CFSTI CSCL 20K

Vibration testing methods are discussed for aircraft structures in the presence of dry friction. Modification procedures to minimize dry friction include loosening the control surfaces from the steering gear, locking the kinematics of the control surfaces, modifying the

balance of the control surfaces, and superposing model characteristics of the structure without control surfaces and steering gear. Author

N70-27445# Northrop Corp., Hawthorne, Calif. Aircraft Div.
FRACTURE MECHANICS GUIDELINES FOR AIRCRAFT STRUCTURAL APPLICATIONS Final Report, Jan. – Nov. 1969
David P. Wilhem Feb. 1970 201 p refs
(Contract F33615-69-C-1313)
(AD-702528; NOR-69-142; AFFDL-TR-69-111) Avail: CFSTI CSCL 1/3

The document provides the guidelines, limitations, and modifications required to perform a structural, fracture analysis using Griffith-Irwin, fracture mechanics principles. It serves as an introduction to fracture mechanics for those personnel who are concerned with fracture strength estimates for aerospace structural applications. Illustrations and hypothetical examples are included which show how engineering solutions for critical crack size and fracture stress may be made. The critical stress intensity (fracture toughness) concept is used as a basic factor for the fracture analysis of materials. For most crack situations, a stress intensity factor can be computed which can be related to critical conditions and estimates made of critical crack lengths, stresses, and crack propagation behaviors. To provide a complete and accurate fracture analysis, the user is encouraged to become familiar with all aspects of the analysis and its limitations. Author (TAB)

N70-27508# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
CONTRIBUTION TO THE MECHANICAL OSCILLATION PROBLEM (GROUND RESONANCE) [BEITRAEGE ZUM BODENRESONANZPROBLEM]
Rolf Schroeder Dec. 1969 69 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-93) Avail: CFSTI

The mechanical oscillations (ground resonance) of a rotor with two lag-hinged rotor-blades were measured. Three sets of blades with different lengths were used, the rotor having three different heights above the ground where the rubber springs of the system were situated. The spatial system had a symmetrical mass disc distribution with equally stiff springs at the same distance from the vertical center-line of the system. The mass and spring properties of the system were functions of the height of the rotor from the ground. Three sets of blades having the same mass but different distances of their mass centers from the lag hinges were employed. The lag angles of the blades and the deflection of one point of the non-rotating system were measured as functions of time within and without the regions of instability, the rotor speeds being kept constant. The complete equations of motion for some rotors with hinged blades and effective hub masses, executing oscillations in a horizontal plane only, were derived and compared with some simplified equations. Author (ESRO)

N70-27511# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.
CALCULATIONS OF STRAINS AND STRAIN RATES IN BENDING CREEP TESTS
G. R. Terwilliger and R. S. Gordon Dec. 1969 13 p refs
(Contract AT(11-1)-1591)
(COO-1591-9; UTEC-MSE-69-157) Avail: CFSTI

Calculations of strains and strain rates from deflection data obtained by measurements at the load points are considered. The experiments were undertaken to determine why strain rates should decrease with increasing strain due to some mechanism inherent in four-point bending tests. Author

N70-27532# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Mulheim an der Ruhr (West Germany). Inst. fuer Festigkeit.
THE DYNAMIC PHOTOELASTIC EFFECT OF BIREFRINGENT COATINGS UNDER SHORT-TIME LOADING (CONTRIBUTION TO DYNAMIC THICKNESS EFFECT) [DAS SPANNUNGSOPTISCHE OBERFLAECHENSCHICHTVERFAHREN BEI KURZZEITIGER BAUTEILBELASTUNG (BEITRAG ZUM DYNAMISCHEN DICKENEFFEKT)]
Horst Schwieger and Albrecht Gysler Feb. 1970 65 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-06) Avail: CFSTI

The resulting effect of a photoelastic layer glued onto a rectangular rod under short-time loading depends on the velocities of propagation of the elastic waves in the system structure-layer and the thickness of the layer. Theoretical estimations have shown that the maximum length of a rectangular elastic pulse propagating along the intersection of this system can be measured only up to a certain thickness of the coating. The dependence between the length of the pulse and the thickness of the layer is designated as the dynamic thickness-effect. The optical effects of various thick layers of epoxy-resins were visualized using high-speed pyotography and were measured photoelectrically. The dynamic strainfringe values were found to be different to static values by an amount of 20%. Author (ESRO)

N70-27537# Hayes International Corp., Birmingham, Ala.
WIND TUNNEL TESTS AND ANALYSES FOR GROUND-MOUNTED, AIR-SUPPORTED STRUCTURES Technical Report
A. E. Dietz, R. B. Proffitt, R. S. Chabot, E. L. Moak, and C. J. Monego Jul. 1969 253 p refs Supersedes USA-NLABS-TR-67-36ME
(Contract DA-19-129-AMC-953(N))
(AD-701203; USA-NLABS-TR-70-7-GP) Avail: CFSTI CSCL 13/13

The objective of the program is to provide tentage information based on wind tunnel test data that can be applied either to the evaluation and improvement of existing ground-mounted, air-supported tents or to the design of such future structures. The study includes data on cylindrical shelters with elliptical ends, the bending stiffness of an inflated beam, vibration characteristics of single-wall and double-wall shelters, the effect of wind skirts on the ground anchors, and a study of factors to improve the stability of double-wall shelters. Tests were conducted at stabilized wind speeds up to 110 miles per hour. In the analytical phase, test data were used to develop fabric stress and aerodynamic coefficient data variation with tent parameters. Results of the wind tunnel investigations and stress analyses were incorporated and include comprehensive, practical design data suitable for engineering reliable, stable, single- and double-wall, air-supported shelters. Author (TAB)

N70-27569# Technische Hogeschool, Delft (Netherlands). Dept. of Aircraft Engineering.
BENDING AND RESILIENCE OF PLATES. VOLUME A: TEXT [BUIGEN EN TERUGVEREN VAN PLATEN. BAND A: TEKST]
F. Hospers Aug. 1968 139 p refs In DUTCH
(VTH-146-Vol-A) Avail: CFSTI

This report contains a survey of literature concerning the pure (plastic) bending and the resilience of plates. Several assumptions are mentioned and discussed. Three theories for the calculation of the resilience are discussed and the results are compared. The differences between the results are analysed. Suggestions are given for a continuation of the research, both theoretical and experimental, into bending and resilience phenomena. It is intended to include in this research not only pure bending, but also real bending processes. Author (ESRO)

N70-27570# Technische Hogeschool, Delft (Netherlands). Dept. of Aircraft Engineering.
BENDING AND RESILIENCE OF PLATES. VOLUME B: DIAGRAMS [BUIGEN EN TERUGVEREN VAN PLANTEN. BAND B: FIGUREN]
F. Hospers Aug. 1968 27 p In DUTCH
(VTH-146-Vol-B) Avail: CFSTI

Diagrams concerning the plastic bending and resilience of plates studied in VTH-146-Vol-A (see N70-27569) are presented. ESRO

N70-27571# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Aircraft Engineering.
BENDING AND RESILIENCE OF PLATES. VOLUME C: GRAPHS [BUIGEN EN TERUGVEREN VAN PLATEN. BAND C: GRAFIEKEN]
F. Hospers Aug. 1968 37 p In DUTCH
(VTH-146-Vol-C) Avail: CFSTI

Graphs concerning the plastic bending and resilience of plates studied in VTH-146-Vol-A (see N70-27569) are presented. ESRO

N70-27572# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Aircraft Engineering.
BENDING AND RESILIENCE OF PLATES. VOLUME D: APPENDICES [BUIGEN EN TERUGVEREN VAN PLANTEN. BAND D: BIJLAGEN]
F. Hospers Aug. 1968 65 p refs In DUTCH
(VTH-146-Vol-D) Avail: CFSTI

Appendices to the survey of literature concerning the bending and resilience of plates studied in VTH-146-Vol-A (see N70-27569) are given. ESRO

N70-27620# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Muelheim (West Germany). Inst. fuer Festigkeit.
DYNAMIC STABILITY OF FLEXIBLE MISSILES [DYNAMISCHE STABILITAET BIEGSAMER STABRAKETEN]
Karl Wohlhart Feb. 1970 57 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-03) Avail: CFSTI

A Timoshenko beam with variable cross-section under the action of a constant follower force was used as a model for a slender missile, the undisturbed motion of the beam being against the force of a constant gravity field. The differential equations together with the boundary conditions are given for the disturbed motion of the beam which moves in its axial direction with constant acceleration. The direction of the follower force, applied at an assumed cross-section of the beam, is derived from the angle through which the element of the beam turns at the po... application of the follower force. With the aid of power s... following effects on the stability of motion are investigate... influence of the rotary inertia and the shear deformation of the beam, the influence of a change of the point of application of the follower force along the beam's axis, the influence of the magnitude of the direction parameter of the follower force. Finally it is shown for different forms of the beam how the mass and rigidity distribution alters the critical follower force. Author (ESRO)

N70-27624*# Chrysler Corp., Huntsville, Ala. Space Div.
COMPUTER PROGRAMS FOR PREDICTION OF STRUCTURAL VIBRATIONS DUE TO FLUCTUATING PRESSURE ENVIRONMENTS. VOLUME 1: THEORETICAL ANALYSES Final Report
Tain N. Lee and Wayne L. Swanson 31 Jul. 1969 155 p refs
(Contract NAS8-21403)
(NASA-CR-102517; HSM-R28-69-Vol-1) Avail: CFSTI CSCL 20K

Formulations were derived and programs were written to calculate the random vibrational responses of rectangular cylindrical panels cross-reinformed with ribs and stringers subjected to the fluctuating pressure environments. Three boundary conditions are considered: four edges simply supported; four edges clamped; two opposite edges simply supported and the other two clamped. Complete cylinders and flat panels are also included. The programs can be selected to run on any one or all three of the boundary conditions. The programs apply when either the complete panel or a portion of it is subjected to the excitation pressure. Input data include only the geometric dimensions and material properties of the panel. Formulations are according to the normal mode approach. The responses calculated are the acceleration, the displacement, and the stress spectral densities. Mean-square and root-mean-square values are calculated by numerical integration. Expressions for the joint acceptance of all mode combinations for different correlation functions are derived. Both the local responses at any point and the average responses over the complete panel are calculated. Author

N70-27625*# Chrysler Corp., Huntsville, Ala. Space Div.
COMPUTER PROGRAMS FOR PREDICTION OF STRUCTURAL VIBRATIONS DUE TO FLUCTUATING PRESSURE ENVIRONMENTS. VOLUME 2: USERS' MANUAL FOR PROGRAM RANDOM Final Report
Tain Nien Lee and James Kermit Moore 31 Jul. 1969 64 p
(Contract NAS8-21403)
(NASA-CR-102518; HSM-R28-69-Vol-2) Avail: CFSTI CSCL 20K

The manual contains three sections describing the problem, the programming, and the deck setup in detail. Author

N70-27800# IIT Research Inst., Chicago, Ill. Dept. of Mechanics.
LOWER BOUND LIMIT ANALYSIS OF PLANE STRESS PROBLEMS BY A FINITE ELEMENT METHOD
T. Belytschko (Illinois Univ., Chicago) and Philip G. Hodge, Jr. Mar. 1970 28 p refs
(Contract N00014-67-A-0210-0002)
(AD-702403; DOMIIT-1-42) Avail: CFSTI CSCL 13/13

In a recent paper, Hayes and Marcel developed a finite element method for determining upper bounds on the limit load for perfectly plastic plane stress problems. By means of a finite element technique, they constructed a parametric family of kinematically admissible velocity fields and then obtained a best upper bound by minimizing the associated load multiplier. The present paper describes a complementary method for finding the lower bound on the limit load for plane stress problems. In this case, the finite element technique is used to construct a parametric family of equilibrium stress fields. The determination of the best lower bound then becomes a problem of mathematical programming: the maximization of the objective function, the load multiplier, subject to the constraint that the yield condition not be violated. The lower ... und method and an upper bound method similar to that of H... s and Marcal were coded as FORTRAN IV programs and res... s were obtained for a number of problems. TAB

N70-27801# IIT Research Inst., Chicago, Ill. Dept. of Mechanics.
YIELD-POINT RING LOAD OF FILLED CIRCULAR CYLINDRICAL SHELLS
Pawan K. Agrawal and Philip G. Hodge, Jr. Mar. 1970 38 p refs
(Contract N00014-67-A-0210-0002)
(AD-702404; DOMIIT-1-43) Avail: CFSTI CSCL 13/13

The yield-point load was obtained for circular cylindrical shells which are filled with an incompressible fluid and loaded by a ring of pressure at the center. Three kinds of end supports were considered and the yield load was determined for all lengths of the cylinder. The results obtained were compared with solutions for unfilled shells. Author (TAB)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N70-26550 National Lending Library for Science and Technology, Boston Spa (England).
PROTECTIVE MEASURES AGAINST DUST EXPLOSIONS [SCHUTZMASSNAHMEN GEGEN STAUBEXPLOSIONEN]
G. Kuehnen Nov. 1969 16 p refs Transl. into ENGLISH from Berufsgenossenschaft v. 11, Nov. 1967 p 408–412
(NLL-SMRE-TRANS-5707-(8313.4)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

On the occasion of a dust explosion in a chemical plant described at the beginning, the conditions which must exist simultaneously for such a disaster to occur are indicated. The author puts forward ways of avoiding dust explosions and distinguishes between explosion dangers in equipment and in industrial premises. The main emphasis is placed on the need to recognize dangerous deposits of dust, transport problems in the presence of dust, particularly effective dust extraction, and the prevention of dust deposition through constructional measures. In addition, certain precautions are recommended which may help to prevent the further spread of a fire or explosion. Author

N70-26574 Colorado Univ., Denver.
THERMAL PROPERTIES OF SELECTED EVACUATED POWDER INSULATIONS AT CRYOGENIC TEMPERATURES
Bruce Lee Knight (Ph.D. Thesis) 1969 322 p
Avail: Univ. Microfilms: HC $14.65/Microfilm $4.15 Order No. 69-19554

Experimental data was obtained to permit the determination of the temperature dependence of the thermal diffusivities and apparent mean thermal conductivites of several selected evacuated powders commonly used as low temperature insulations. The apparent mean thermal conductivities of selected evacuated powders were measured as functions of temperature using steady state methods. The thermal diffusivities of four evacuated powders were determined as functions of temperature from transient thermal response measurements made on the samples. The conductivity and diffusivity were found to be temperature dependent in all cases, with the thermal diffusivity varying by as much as a factor of four over the temperature range of 76–300 K. Powders investigated include a silica-aluminum mixture, carbon, silica-magnesia and perlite. The theory for the transfer of heat in finely divided powders is presented. Included are discussions of the various transport mechanisms and methods for the prediction of the thermal transport properties involved. Dissert. Abstr.

N70-26632# Massachusetts Inst. of Tech., Cambridge. Heat Transfer Lab.
MECHANISM AND BEHAVIOR OF NUCLEATE BOILING HEAT TRANSFER TO THE ALKALI LIQUID METALS Technical Report
Charles Deane, IV and Warren M. Rohsenow Oct. 1969 163 p refs
(Contract AT(30-1)-3357)
(TID-25294; TR-76303-65) Avail: CFSTI

A model of boiling heat transfer to the alkali liquid metals is postulated from an examination of the events and phases of the nucleate boiling cycle. The model includes the important effect of microlayer evaporation which causes a wave of temperature depression to penetrate into the heating solids; calculated results predict the periodic boiling behavior in the heating solid as a function of the heat flux, the system pressure, the cavity size, and the thermophysical properties of the liquid and the solid. An experimental program was designed to examine the microscale boiling behavior of sodium and to verify the calculated predictions of the boiling model. Artificial cylindrical cavities are used in most of the test sections; a thermocouple is placed close to the boiling surface and adjacent to the cavity wall, and microscale temperature measurements were obtained for stable boiling of sodium from artificial cavities and also from a neutral cavity. Author (NSA)

N70-26749# Scientific Translation Service, Ann Arbor, Mich.
EXPERIMENTAL METHODS IN LIQUID METAL SYSTEMS
V. I. Subbotin et al Jan. 1970 20 p refs Transl. into ENGLISH from Teploobmen Pri Kipenii Metal. v Usloviyakh Estestnennoi Konvektsii (Moscow), 1969 p 40–52 Prepared for Argonne Natl. Lab.
(ANL-Trans-793) Avail: CFSTI

Certain specific aspects of temperature measurement in heat transfer experiments with boiling metals are considered. These include correction for the temperature difference in the heat-transferring wall and for the distortion of the temperature field at the point of thermocouple installation; time variation of the temperature of the fluid and of the heat-transferring wall; and variation of the characteristics of the thermocouple during the process of operation. The design and construction of microthermocouples for the measurement of high temperatures in experiments with boiling metals are discussed. NSA

N70-26832# Aix-Marseilles Univ. (France). Inst. of Fluid Mechanics.
FLOW WITH NON-NEWTONIAN VISCOSITY FUNCTION FROM THE TEMPERATURE IN A TUBE WITH HEAT TRANSFER AT THE WALL CONSTANT [ECOULEMENT AVEC VISOSITE NON NEWTONIENNE FONCTION DE LA TEMPERATURE DANS UN TUBE AVEC TRANSFERT DE CHALEUR A LA PAROI CONSTANT]
Michele Siouffi-Freyder (Ph.D. Thesis) 31 Jan. 1969 83 p refs In FRENCH
Avail: CFSTI

Laminar and permanent flow characteristics are studied by a non-Newtonian viscosity function and from the temperature in the vertical circular cylindrical tube heated so that the heat transfer at the wall is constant. Experimental results are given in terms of temperature profiles, thermal boundary layer profiles, and the variation of the Nusselt number. Good agreement is obtained between experimental and theoretical results. Transl. by J.M.C.

N70-26982 National Lending Library for Science and Technology, Boston Spa (England).
THE DEPENDENCE OF THE COMBUSTION RATE OF A LIQUID ON THE TEMPERATURE AT ITS SURFACE [O ZAVISIMOSTI SKOROSTI SGORANIYA ZHIDKOSTI OT TEMPERATURY NA EE POVERKHNOSTI]
V. E. Anisimov et al Feb. 1970 13 p refs Transl. into ENGLISH from Inzh.–Fiz. Zh. (Moscow), v. 6, no. 8, 1963 p 45–51
(NLL-RTS-5528) Avail: Natl. Lending Library, Boston Spa, Engl.: 17s 6d or 2 NLL photocopy coupons

The extinguishing of burning liquid and the associated changes in combustion rate as the temperature of the hot liquid surface is reduced are investigated. Various cylindrical burners and vessels were used in the experiments and different methods were used to reduce the temperature. Curves are plotted which show the dependence of flame height on the liquid surface temperature. R.B.

N70-26974# National Aeronautical Establishment, Ottawa (Ontario). Unsteady Aerodynamics Section.
INITIAL STUDIES OF LOW TEMPERATURE ABLATION IN

A HELIUM HYPERSONIC WIND TUNNEL
D. L. Kohlman, L. Elias, and K. Orlik-Ruckemann Jun. 1969 59 p refs Sponsored by AEC Prepared for the Sandia Corp.
(PB-187703; NAE-LTR-UA-7; SC-CR-69-3215) Avail: CFSTI CSCL 14B

Exploratory experiments were carried out at Mach 16.4 and at 600 psi stagnation pressure using metal models at room temperature, models with cooper inserts, cooled to −140C, and models with carbon dioxide inserts. All models were flat plates at zero incidence with a sharp leading edge in front of the insert. Surface temperature, surface recession rates and pitot pressure profiles were determined at several longitudinal stations. Suitable model fabrication and experimental techniques were developed. A simple theoretical method of predicting recession rates and surface temperatures was proposed. It was demonstrated that the ablation of carbon dioxide into an unheated Mach 16.4 helium flow at 600 psi stagnation pressure is significant enough to result in measurable flat plate recession rates and measurable changes in pitot pressure profiles. In addition, it was shown that it is possible to distinguish between the effects on pitot pressure of reduction in surface temperature and of mass addition through sublimation of carbon dioxide. It was also found that the first order theoretical analysis predicts proper trends and correct approximate magnitude of sublimation rates. Author (USGRDR)

N70-26991# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMUM SYSTEMS OF HEAT DISSIPATION BY RADIATION (SURVEY)
G. L. Grodzovskii et al 5 Nov. 1969 18 p refs Transl. into ENGLISH from Proceedings of the 18th Intern. Astronautical Congr. (Belgrade), 1967 p 1–12
(AD-700317; FTD-MT-24-31-69) Avail: CFSTI CSCL 13/1

The article discusses available data on various optimal systems of evacuating heat energy by radiation. A radiating system with fins of optimal shape is considered first, together with the problem of minimizing the weight of the system. The influence of the number of fins on the optimal form of the fins, and also on the cross section of a starlike radiator, is presented in graphs. Next, systems with heat radiating fins of rectangular and triangular cross sections are considered and the results obtained by various authors are analyzed. A comparison of various systems is given in a graph with respect to their mass efficiency. Systems of heat energy evacuation by belt radiators designed for minimizing meteoroid vulnerability are discussed and a comparison between the specific weights of belt and conventional finned radiators is presented in a graph on the basis of previously determined data. Author (TAB)

N70-27075*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
USER'S MANUAL FOR RAVFAC: A RADIATION VIEW FACTOR DIGITAL COMPUTER PROGRAM
J. K. Lovin and A. W. Lubkowitz Nov. 1969 125 p refs
(Contract NAS8-30154)
(NASA-CR-61321) Avail: CFSTI CSCL 20M

A new technique for calculating diffuse radiation view factors was developed using contour integrals. This technique along with the finite difference (double summation) was incorporated into a Radiation View Factor Digital Computer Program (RAVFAC). Two techniques for calculating radiation view factors were included in RAVFAC because the contour integral offers greater accuracy and the finite difference offers faster run times. A combination of the two provides accurate results and keeps the run time within reason. A technique was also developed and incorporated into RAVFAC to account for the effects of shading by other surfaces. The calculation of shading effects is lengthy and requires a significant amount of computer time. A computer routine was developed that reduces the run time by eliminating surfaces that cannot cause shading on the areas for which the view factors are being calculated. Author

N70-27100# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
NON-DIFFUSIVE EFFECTS IN THE RADIATIVE PROPAGATION OF A THERMAL PULSE Technical Report
Stephen C. traugott Dec. 1969 44 p refs
(Contract AF 49(638)-1726)
(AD-701445; RIAS-TR-69-18C; AFOSR-70-0321TR) Avail: CFSTI CSCL 20/13

The very early, pre-hydrodynamic transport of energy by radiation in a strong explosion is studied, taking departures from the Rosseland diffusion approximation into account. Similarity solutions exist for the plane, cylindrical, and spherical cases when the grey absorption coefficient varies as a power of temperature which is 1, 1/2, and 1/3 respectively. Solutions are found for the plane and spherical case using both the technique of matched asymptotic expansion and numerical integration. These solutions allow computation of temperatures and heat flux as a function of time, distance from the center, and energy release. Non-diffusive radiation leads to a relatively cool precursor to the main portion of the thermal wave. This precursor is much less pronounced in the spherical case. It is also found possible to predict the temperature visible to a distant observer. Author (TAB)

N70-27130*# North American Rockwell Corp., Downey, Calif. Space Div.
NONISENTROPIC FINITE-AMPLITUDE WAVE GENERATION Final Report, Jun. – Dec. 1969
A. C. Peter Dec. 1969 153 p refs
(Contract NAS8-21406)
(NASA-CR-102659; SD-69-722) Avail: CFSTI CSCL 20M

The problem of entropic gas flow effects is further extended, using the J-function theory. It is shown that the calssical gas constant R becomes an entropic variable, with a resulting degradation of a perfect gas, when subjected to high entropy gradients. Thermodynamic equations for initial as well as developed gas flows are also derived. Application of the results to the case of adiabatic duct flows indicates that subsonic frictional flows are governed by the developed-flow equations, except in the initial stages of flow development. It is also shown that supersonic frictional duct flows do not admit continuous decelerations, and transition must take place through shock formation exclusively. Author

N70-27182*# Case Western Reserve Univ., Cleveland, Ohio. School of Engineering.
THE COMPRESSIBLE LAMINAR BOUNDARY LAYER WITH HEAT TRANSFER ON A YAWED CONE AT SMALL ANGLE OF ATTACK
Richard J. Bodonyi and Eli Reshotko Jan. 1970 92 p refs
(Grant NGL-36-003-064)
(NASA-CR-109839; FTAS/TR-70-48) Avail: CFSTI CSCL 20M

A perturbation method for the calculation of velocity and temperature profiles and skin-friction and heat transfer coefficients is presented for the flow in the compressible laminar boundary layer about a yawed cone in a supersonic stream. Both insulated and noninsulated surfaces are considered. Numerical solutions of the governing differential equations are given in terms of universal functions which are tabulated for Prandtl number of 0.72 and 1.00. Theoretical heat transfer rates are compared to existing experimental data. Author

N70-27186# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
DETERMINATION OF THE ELECTRONIC TEMPERATURE OF A FLAME BY SPECTROSCOPY (OCTOBER 1968–AUGUST 1969). [DETERMINATION DE LA TEMPERATURE ELECTRONIQUE D'UNE FLAMME PAR METHODE SPECTROSCOPIQUE (OCTOBRE 1968–AOUT 1969)]
Jean-Sebastien Peskine Mar. 1970 24 p refs In FRENCH;

ENGLISH summary
(CEA-R-3926) Avail: CFSTI

The report deals with the determination of the electron temperature of a flame by a spectroscopic method. It is shown that a modification of the flame emission occurs with an alternating electrical field. The emitted radiation is modulated at double the frequency of the electrical field and its spectral distribution is considerably altered. There are certain indications that the radiation emitted by the continuous electron background is isolated from the rest of the flame emission and further research may show a relationship between this radiation and the electron energy. Author (ESRO)

N70-27234# Argonne National Lab., Ill.
REVIEW OF BRITISH PROGRAM OF FLUIDIZED-BED COMBUSTION: REPORT OF US TEAM VISIT TO ENGLAND, 17-28 FEBRUARY 1969
E. L. Carls Aug. 1969 48 p refs
(Contract W-31-109-eng-38)
(ANL/ES-CEN-1000) Avail: CFSTI

The development of fluidized-bed combustion systems for fossil fuels is investigated. Information is given on research facilities, experimental results, development programs in progress, and expected future work. Experimental efforts and conceptual design studies are aimed at the development of four types of fluidized-bed coal-combustion systems: an atmospheric-pressure utilized-sized unit, an industrial shell boiler, a pressurized fluidized-bed combustor, and a packaged water-tube boiler. In addition, application of the technique of fluidized-bed combustion to various fuel-oil burning systems is being studied. Author

N70-27274*# Translation Consultants, Ltd., Arlington, Va.
HYSTERESIS OF THE HEAT TRANSFER COEFFICIENT IN DEPENDENCE OF THE HEAT-FLUX DENSITY MEASURED ON A THERMOSIPHON REBOILER [HYSTERESE IM VERLAUF DER WAERMEDURCHGANGSZAHL ABHAENGIG VON DER WAERMESTROMDICHTE, GEMESSEN AN EINEM NATURUMLAUFVERDAMPFER]
Lothar Setzpfandt Washington NASA Apr. 1970 7 p ref
Transl. into ENGLISH of German conf. paper To be presented at the Intern. Heat Transfer Conf., Paris, 30 Aug.–5 Sep. 1970
(Contract NASw-2038)
(NASA-TT-F-13048) CSCL 20M

Heat transfer measurings with benzol as test liquid carried out on an industrially manufactured thermosiphon reboiler resulted, at determined heat flux densities q in different heat transfer coefficients k for increasing q, decreasing q respectively. The test results permit to come to the conclusion that due to a slightly rusted heating surface a greater or smaller number of places for the formation of bubbles will be activated, depending on the operating conditions. Author

N70-27275*# Translation Consultants, Ltd., Arlington, Va.
TRANSFER OF FLUX GREATER THAN 1kW/sq cm BY DOUBLE PHASE CHANGE BETWEEN A NON-ISOTHERMAL WALL AND A LIQUID WITH FORCED CONVECTION [TRANSFERT DE FLUX SUPERIEUR A 1 kW/sq cm PAR DOUBLE CHANGEMENT DE PHASE ENTRE UNE PAROI NON ISOTHERME ET UN LIQUIDE EN CONVECTION FORCEE]
Charles A. Beurtheret Washington NASA Apr. 1970 18 p refs Transl. into ENGLISH of Thomson-CSF conf. paper To be presented at the Intern. Heat Transfer Conf., Paris, 30 Aug.–5 Sep. 1970
(Contract NASw-2038)
(NASA-TT-F-13047) Avail: CFSTI CSCL 20M

A circulation of liquid is set up in the vicinity of a wall capable of stabilizing the vaporization of semipellicular transition with contact of a network of anisothermal extensions (VAPOTRON effect). The qualitative condensation of the vapor allows anisothermal components to support a complex vaporization system which is stable throughout the whole temperature range up to the Leidenfrost Point. The efficiency can exceed, on the average, the Nuki-yama flux peak and even produce an avalanche system. This HYPER-VAPOTRON technique can be used throughout the whole conductivity range of metal walls. Author

N70-27326# Akademia Nauk URSR, Kiev.
HEAT TRANSFER IN POWER ENGINEERING UNITS
P. Ya. Furer, ed. 1967 125 p refs In RUSSIAN
Avail: CFSTI

CONTENTS:

1. THE EFFECT OF CERTAIN FACTORS ON THE EFFECTIVENESS OF THE AIR COOLING SYSTEM FOR THE HIGH PRESSURE TURBINE ROTOR OF THE GTU-4-750 KTZ GAS TURBINE Y. P. Dyban and V. N. Klimenko p 7–17 refs (See N70-27327 13-33)

2. THE HEAT EXCHANGE CRISIS IN ANNULAR CHANNELS 0.4 mm WIDE V. I. Tolubinskiy, A. K. Litoshenko, and V. L. Shevtsov p 18–25 refs (See N70-27328 13-33)

3. VOLUMETRIC TEMPERATURE FIELDS OF A TURBINE BUCKET WITH INTERNAL COOLING L. A. Kozdoba and L. V. Knyazev p 26–35 refs (See N70-27329 13-33)

4. HEAT TRANSFER IN PIPES WITH WIRE VORTEX GENERATORS N. V. Zozulya and I. Y. Shkurstov p 36–38 refs (See N70-27330 13-33)

5. TRANSIENT PROCESSES IN A NONLINEAR DYNAMIC SYSTEM OF A TWO-SHAFT GAS TURBINE V. I. Fedorov and A. S. Veremeyenko p 39–48 refs (See N70-27331 13-33)

6. EXPERIMENTAL STUDY OF HEAT TRANSFER DURING SUCTION THROUGH THE POROUS WALL OF A CHANNEL G. K. Kotyrio and G. M. Shchegolen p 49–56 refs (See N70-27332 13-33)

7. HYDRAULIC RESISTANCE OF THE AIR COOLING SYSTEM OF A GAS TURBINE ROTOR S. Z. Kopelev and S. V. Gurov p 57–70 refs (See N70-27333 13-12)

8. METHOD OF CALCULATING THE TRANSIENT PROCESSES IN REGENERATIVE GAS TURBINES V. I. Fedorov and Z. A. Martsenyuk p 71–80 refs (See N70-27334 13-33)

9. UNIT FOR THE EXPERIMENTAL STUDY OF THE HEAT CONDUCTIVITY OF SOLIDS IN THE 200 TO 1500 C TEMPERATURE RANGE F. F. Lezhenin p 81–87 refs (See N70-27335 13-11)

10. INVESTIGATING THE NONSTATIONARY TEMPERATURE FIELD IN A MULTIPLE LAYER CYLINDRICAL WALL OF A STEAM TURBINE VALVE D. A. Pereverzev p 88–100 refs (See N70-27336 13-33)

11. HEAT TRANSFER AND HYDRAULIC RESISTANCE OF PIPES WITH WIRE WELDED RIDGES N. V. Zozulya and A. A. Khavin p 101–106 refs (See N70-27337 13-33)

12. DEPENDENCE OF THE EFFECTIVENESS OF THE THERMAL PROTECTION OF A PLANE SURFACE ON THE FLOW CONDITIONS AND THICKNESS OF THE INITIAL DYNAMIC BOUNDARY LAYER IN THE BASIC FLOW WHEN INJECTING AIR THROUGH A TANGENTIAL SLOT K. A. Bogachuk-Kozachuk, Ya. G. Popovich, and V. M. Repukhov p 107–120 refs (See N70-27338 13-33)

13. SPECIAL FEATURES OF CALCULATING THE TEMPERATURE FIELDS OF AIR-COOLED ROTORS OF CENTRIPETAL GAS TURBINES A. F. Kolesnichenko p 121–131 refs (See N70-27339 13-33)

N70-27327# Akademia Nauk URSR, Kiev.
THE EFFECT OF CERTAIN FACTORS ON THE EFFECTIVENESS OF THE AIR COOLING SYSTEM FOR THE HIGH PRESSURE TURBINE ROTOR OF THE GTU-4-750 KTZ GAS TURBINE

Ye. P. Dyban and V. N. Klimenko *In its* Heat Transfer in Power Eng. Units 1967 p 7–17 refs In RUSSIAN (See N70-27326 13-33)
Avail: CFSTI

The main task in the study of air cooling systems is the establishment of the optimal conditions for the operation of the system, when the temperature fields of all parts are maintained for the minimum possible initial pressure and discharge of cooling air. This problem was recently solved in connection with the rotor of a high pressure turbine. Steps in this solution included a theoretical study of the cooling system variants of the main model of the unit, determination of the basic factors which affect the effectiveness of its operation, and development of an optimal variant on the basis of these data. Suggestions for increasing the efficiency of the cooling system for this unit are given. Transl. by H.W.

N70-27328# Akademia Nauk URSR, Kiev.
THE HEAT EXCHANGE CRISIS IN ANNULAR CHANNELS 0.4 mm WIDE
V. I. Tolubinskiy, A. K. Litoshenko, and V. L. Shevtsov *In its* Heat Transfer in Power Eng. Units 1967 p 18–25 refs In RUSSIAN (See N70-27326 13-33)
Avail: CFSTI

The heat exchange crisis was investigated during boiling under conditions of forced motion of water. Results of experiments are presented for unilateral external heating in the pressure range 2.5 to 21.6 meganewton per square mm and for mass velocities of 100 to 400 kg per square meter per second for the length of the test elements of 20, 40, and 70 mm. Finding agree with earlier work. Transl. by H.W.

N70-27329# Akademiya Nauk URSR, Kiev.
VOLUMETRIC TEMPERATURE FIELDS OF A TURBINE BUCKET WITH INTERNAL COOLING
L. A. Kozdoba and L. V. Knyazev *In its* Heat Transfer in Power Eng. Units 1967 p 26–35 refs In RUSSIAN (See N70-27326 13-33)
Avail: CFSTI

A three-dimensional electrical model is discussed of the temperature fields for a turbine bucket with internal cooling. The effect of various factors on the cooling effectiveness of the shape are considered. These include: the gas temperature and the distribution of this temprature through the bucket; changes in and the redistribution of coolant air along the separate channels of the base; and the values of local coefficients of heat exchange from the gas to the fin of the bucket. It is shown that a three-dimensional model satisfies testing requirements better than a two-dimensional or planar model. Transl. by H.W.

N70-27330# Akademia Nauk URSR, Kiev.
HEAT TRANSFER IN PIPES WITH WIRE VORTEX GENERATORS
N. V. Zozulya and I. Ya. Shkuratov *In its* Heat Transfer in Power Eng. Units 1967 p 36–38 refs In RUSSIAN (See N70-27326 13-33)
Avail: CFSTI

Experimental data are presented on the effect of spiral wire vortex generators on the heat transfer and hydraulic resistance when cooling transformer oil inside pipes. Different geometric characteristics of the spirals were investigated (according to the diameter of the wire and the spacing between the loops). An evaluation is made of the thermal effectiveness of the heat exchanger surfaces using such vortex generators. The generators proved to be highly effective for intensifying convective heat transfer to viscous liquids within the range of the small Re numbers investigated. Transl. by H.W.

N70-27331# Akademia Nauk URSR, Kiev.
TRANSIENT PROCESSES IN A NONLINEAR DYNAMIC SYSTEM OF A TWO-SHAFT GAS TURBINE
V. I. Fedorov and A. S. Veremeyenko *In its* Heat Transfer in Power Eng. Units 1967 p 39–48 refs In RUSSIAN (See N70-27326 13-33)
Avail: CFSTI

Methods are discussed for analyzing the transient processes in a nonlinear dynamic system of a two-shaft gas turbine (GTU-50-800), which has regeneration, graduated compression, intermediate air cooling, and heating of the actuating medium. For a nonlinear system of differential equations of the 14th order, a solution algorithm was derived using the BESM-2 computer. As an example, the characteristics were obtained of the transient processes of the unit during graduated disturbance in the load. These characteristics show that changes of many variables are accompanied by oscillations of small amplitude. Transl. by H.W.

N70-27332# Akademia Nauk URSR, Kiev.
EXPERIMENTAL STUDY OF HEAT TRANSFER DURING SUCTION THROUGH THE POROUS WALL OF A CHANNEL
G. K. Kotyrlo and G. M. Schegolev *In its* Heat Transfer in Power Eng. Units 1967 p 49–56 refs In RUSSIAN (See N70-27326 13-33)
Avail: CFSTI

Heat transfer is experimentally studied for the case of the transfer from the permeable wall of the channel to the flow of the cooling agent, part of which is drawn off into the wall. Visual observations are described of the flow in the channel with suction through the porous wall. Experimental results are presented in the form of criterial equations. Transl. by H.W.

N70-27334# Akademiya Nauk URSR, Kiev.
METHOD OF CALCULATING THE TRANSIENT PROCESSES IN REGENERATIVE GAS TURBINES
V. I. Fedorov and Z. A. Martsenyuk *In its* Heat Transfer in Power Eng. Units 1967 p 71–80 refs In RUSSIAN (See N70-27326 13-33)
Avail: CFSTI

The variability of the physical parameters in time and volume are taken into account, as are the results of the transient processes in the regenerator of the GTU-50-800 gas turbine. The method can be used for engineering computations when solving problems of the efficient organization and control of gas turbines with regeneration, as well as in the solution of these problems for heat exchanger equipment. Transl. by H.W.

N70-27336# Akademiya Nauk URSR, Kiev.
INVESTIGATING THE NONSTATIONARY TEMPERATURE FIELD IN A MULTIPLE LAYER CYLINDERICAL WALL OF A STEAM TURBINE VALVE
D. A. Pereverzev *In its* Heat Transfer in Power Eng. Units 1967 p 88–100 refs In RUSSIAN (See N70-27326 13-33)
Avail: CFSTI

A method for computing the irregular temperatures in a multiple layer cylindrical wall is developed. An evaluation of the effectiveness of the operation of cooling screens under heating conditions (measurement of the temperature differences arising in the walls) is given as well as a determination of the heating time of the system as a whole and the time of the arrival of the regulating condition. This method is used for determining the temperature in the heating system in the walls of the valve of a steam turbine. The walls conduct the basic power and temperature loads. Recommendations are presented for the preheating conditions. Transl. by H.W.

N70-27337# Akademiya Nauk URSR, Kiev.
HEAT TRANSFER AND HYDRAULIC RESISTANCE OF PIPES WITH WIRE WELDED RIDGES
N. V. Zozulya and A. A. Khavin *In its* Heat Transfer in Power Eng. Units 1967 p 101–106 refs In RUSSIAN (See N70-27326 13-33)
Avail: CFSTI

The results of thermal engineering studies are given for pipes with wire welded ridges in checkerboard and straight line shapes. The results show the usefulness of this surface for heat exchangers, in particular, those operating with high temperature heat transfer agents. The criterial processing of the data is computed for heat exchangers with heat transfer agents differing in parameters according to the air used in the experiments. Transl. by H.W.

N70-27338# Akademiya Nauk URSR, Kiev.
DEPENDENCE OF THE EFFECTIVENESS OF THE THERMAL PROTECTION OF A PLANE SURFACE ON THE FLOW CONDITIONS AND THICKNESS OF THE INITIAL DYNAMIC BOUNDARY LAYER IN THE BASIC FLOW WHEN INJECTING AIR THROUGH A TANGENTIAL SLOT
K. A. Bogachuk-Kozachuk, Ye. G. Popovich, and V. M. Repukhov *In its* Heat Transfer in Power Eng. Units 1967 p 107–120 refs In RUSSIAN (See N70-27326 13-33)
Avail: CFSTI

Results are presented for an experimental study of the effectiveness of the thermal protection of a plane surface. An increase in the relative thickness of the layer leads to a considerable decrease in the effectiveness and its effect can practically be disregarded. With an increase in the Reynolds number the effectiveness of the thermal protection increases. Transl. by H.W.

N70-27339# Akademiya Nauk URSR, Kiev.
SPECIAL FEATURES OF CALCULATING THE TEMPERATURE FIELDS OF AIR-COOLED ROTORS OF CENTRIPETAL GAS TURBINES
A. F. Kolesnichenko *In its* Heat Transfer in Power Eng. Units 1967 p 121–131 refs In RUSSIAN (See N70-27326 13-33)
Avail: CFSTI

The MSM-1 electronic integrator was used to calculate the values for local temperatures, the size of heat transfer factors, and the relative velocities of the gas in the operating channel of the rotor. An analysis was conducted for the relationships which characterize heat exchange in the operating channels of the rotor. The method used to calculate the temperature fields needs further checking using precise experimental data. Transl. by H.W.

N70-27405# Kansas State Univ., Manhattan. Dept. of Mechanical Engineering.
INVESTIGATION OF CONSTRAINTS IN THERMAL SIMILITUDE, VOLUME 1 Final Report, Sep. 1967–Sep. 1969
Paul L. Miller and Francis W. Holm Dec. 1969 107 p refs
(Contract F33615-68-C-1017)
(AD-701392; AFFDL-TR-69-91-Vol-1) Avail: CFSTI CSCL 22/2

The studies described in the report clarify the effects of some of the limitations imposed by the laws of thermal similitude, and determine the thermal modeling laws for a heat pipe. In Volume 1 solutions were presented for the steady-state temperature distribution and heat transfer in a radiating fin having temperature dependent thermal conductivity. Using these solutions, modeling prediction errors were determined for fin type prototype/model systems with dimensional distortions, with material having temperature dependent thermal conductivity, and with low prototype temperatures. In volume 2 the thermal modeling laws for a heat pipe were derived and experimentally verified. A flexible heat pipe was also designed and experimentally tested. Author (TAB)

N70-27451*# Scientific Translation Service, Santa Barbara, Calif.
CALCULATING HEAT TRANSFER IN DIATHERMAL SYSTEMS IN THE SUPERCRITICAL BOILING REGIME [K RASCHETU TEPLOOBMENA V DIATERMICHNYKH SISTEMAKH S SVERKHKRIZISNYM REZHIMOM KIPENIYA]
Yu. P. Yakovlev Washington NASA May 1970 14 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), no. 2, 1969 p 89–98
(Contract NASw-2035)
(NASA-TT-F-12974) Avail: CFSTI CSCL 20M

A diathermal heat transfer scheme is considered for the case when the surface of the wall is considered to be athermal. Very large thermal fluxes reaching critical values are created on the heat-removing surface of the equipment. It is assumed that the heat exchangers or engine combustion chamber and nozzle operate at very high working fluid temperatures, at which the specific radiant heat fluxes play the dominant role in the heat transfer. Author

N70-27459# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONVECTIVE HEAT AND MASS EXCHANGE (COLLECTION OF ARTICLES)
Z. P. Shulman et al 23 Sep. 1969 360 p refs Transl. into ENGLISH from Akad. Nauk BSSR Inst. Teplo-i Massoobmena, Issled. Konvektivnogo-i Massoperenosa (BSSR), v. 10, 1968 p 1–423
(AD-701234; FTD-HT-23-252-69) Avail: CFSTI CSCL 20/4

The collection contains the results of new and basically experimental studies of various applied problems in the field of heat technology, rheology, industrial aerodynamics (bounded flows, gas streams, porous cooling) drying and heat treatment. Author (TAB)

N70-27499# Royal Aircraft Establishment, Farnborough (England).
HEAT TRANSFER CHARACTERISTICS OF A SPACECRAFT PROPANE BOILER SYSTEM
R. Hastings Dec. 1969 35 p refs
(RAE-TR-69269) Copyright. Avail: CFSTI

A heat sink type of propane boiler system mounted in a representative spacecraft structure has been tested under simulated spacecraft conditions to obtain information about the heat transfer behaviour during continuous operation at various environmental temperatures. The influence of the method of mounting the system in the spacecraft structure upon the performance of the system is discussed and estimates of performance are presented. It has been shown that, provided the system is not completely thermally isolated from the spacecraft, the boiler system will meet the demands of a typical propane attitude control system. It has also been demonstrated that it is possible to operate the system continuously at the designed maximum mass flow rate of 0.33 gm/sec. Author (ESRO)

N70-27536*# Techtran Corp., Glen Burnie, Md.
OPTIMIZATION OF THE PASSIVE DESCENT TRAJECTORY OF A FLIGHT VEHICLE IN THE EARTH'S ATMOSPHERE IN TERMS OF A CRITERION LINKED WITH THE WEIGHT OF THE COOLANT OF THE INTERNAL COOLING SYSTEM [OPTIMIZATSIYA TRAYEKTORII PASSIVNOGO SPUSKA LETATELNOGO APPARATA V ATMOSFERE ZEMLI PO KRITERIYU, SVYAZANNOMU S VESOM KHLADOAGENTA VNUTRENNEY SISTEMY OKHLAZHDENIYA]
A. A. Roshchina Washington NASA Apr. 1970 16 p refs Transl. into ENGLISH from Issled. po Dinam. Poleta, no. 2, 1969 p 246–259
(Contract NASw-2037)
(NASA-TT-F-12939) Avail: CFSTI CSCL 20M

The dynamic characteristics of the reentry trajectory of a winged flight vehicle with a heat protection system consisting

of radiation shielding, an insulating skin, and an internal cooling system are discussed. It is assumed that: (1) the thermophysical properties of the materials are independent of temperature; (2) the radiation from the inner wall into the cabin is negligible; (3) the vehicle drag is an even concave function, while the vehicle lift is an odd function; (4) the flight velocity and altitude are such that the radiative thermal flux is negligibly small in relation to the convective thermal flux; and (5) the aerodynamic coefficients are constant with respect to the Mach number and flight velocity, being dependent only on the angle of attack. Expressions describing the optimality conditions are derived and analyzed. Author

N70-27540*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
THERMODYNAMIC EFFECTS ON DEVELOPED CAVITATION IN WATER AND FREON 113
Michael L. Billet (M.S. Thesis) Mar. 1970 156 p refs
(Grant NGL-39-009-001)
(NASA-CR-109840) Avail: CFSTI CSCL 20M

A theoretical and experimental investigation was conducted into thermodynamic effects in water at temperatures from 80 F to 290 F and in Freon 113 at temperatures from 75 F to 190 F, and the dynamics of the steady state cavity were investigated. A theory of thermodynamic effects on cavitation has been developed from a dynamic approach called the entrainment theory. It has been compared with a previously developed quasi-static theory, the B-factor theory, and found to be similar in form to the thermodynamic effect. However, comparisons of the two theories with experimentally determined temperature depressions obtained as functions of temperature velocity, cavity length, and fluid properties seem to indicate that there exists a definite geometric effect. This implies that the B-factor equation developed from venturi testing will not predict the temperature depression for a zero caliber ogive. Author

N70-27666# Gulf General Atomic, San Diego, Calif.
THERMAL STABILITY TESTING OF AN ELECTRICALLY LOADED SHEATH INSULATOR
J. Chin and C. W. Messick Oct. 1969 16 p refs Presented at the IEEE Thermionic Conversion Specialist Conf., Carmel, Calif., 21–24 Oct. 1969
(Contract AT(04-3)-167)
(GA-9465; CONF-691024-3) Avail: CFSTI

Thermal stability testing of a trilayer niobium/alumina/niobium sheath insulator at 1200 C with 100 volts impressed across the ceramic is described. Resistance measurements across the sheath insulator increased from 33 kilohms to 1.68 megohms during a 5313-hour test. Preferential diffusion of alumina was detected in the inner niobium ring. Grain boundaries in the alumina layer became prominent. Density changes in the alumina layer were apparent. Metallographic, microhardness, and microprobe results are presented. A plasma-sprayed alumina coating applied to the end of the test sample survived the thermal stability test without spalling. Author (NSA)

N70-27670# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
TURBULENT HEAT TRANSFER IN A ROD BUNDLE WITH LIQUID METAL COOLANT
D. J. Bender and P. M. Magee Jul. 1969 102 p refs
(Contract AT(04-3)-189)
(GEAP-0052) Avail: CFSTI

The coupled heat transfer equations in the fuel, gap, cladding, and coolant were solved for a triangular-spaced, close-packed fuel rod bundle with liquid metal coolant. The model includes temperature-dependent material properties, turbulent velocity distribution in the coolant, and contributions to coolant heat transfer by turbulent mixing. The model was programmed as a digital computer code and used in a parametric study to determine the heat transfer characteristics for this geometry as a function of Peclet number, pitch-to-diameter ratio, and linear pin power. Author (NSA)

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N70-26520*# University of Southern Calif., Los Angeles. School of Public Administration.
MULTIDISCIPLINARY RESEARCH IN MANAGEMENT AND ADMINISTRATION WITH EMPHASIS ON LARGE SCALE R AND D PUBLIC PROGRAMS. Progress Report, 18 Jan. 1969–31 Jan. 1970
31 Jan. 1970 49 p refs
(Grant NGL-05-018-098)
(NASA-CR-109645) Avail: CFSTI CSCL 05A

A general perspective for the program is presented, showing where emphasis has been directed, and the probable future evolution of the program is discussed on the assumption of additional financial support. The separate projects are reported in detail, with groupings under three subject areas. The BLUEPRINT effort (Blueprint for Life and Understanding the Environment; Program of Research and Innovation for the New Times) is briefly summarized. Author

N70-26676# Akademiya Nauk URSR, Kiev.
APPLIED ACOUSTICS AND VIBRATION TECHNOLOGY
N. K. Sytnik, ed. 1968 179 p refs In RUSSIAN
Avail: CFSTI

A collection of articles is presented on acoustic and hydroacoustic measurements and construction of acoustic equipment. Problems are considered for wave diffraction, sound propagation, vibration damping, and use of elastic waves in geophysical prospecting and well drilling. For individual titles, see N70-26677 through N70-26698.

N70-26766# Congress. House. Committee on Science and Astronautics.
NATIONAL SCIENCE FOUNDATION 1970 AUTHORIZATION, VOLUME 1
Washington GPO 1969 757 p refs Hearings on H.R. 4283 before Comm. on Sci. and Astronaut., 91st Congr., 1st Sess., No. 4, 17-18 Mar., 20 Mar., 24-28 Mar., and 1 Apr. 1969
Avail: Subcomm. on Sci., Res., and Develop.

Testimony is presented in support of appropriations for activities of the National Science Foundation. Emphasis is given to promotion of basic research and education in the sciences and to modification of the National Science Foundation for achieving the goals of national policies. Progress is reported for the various disciplines in the physical, chemical, and biological sciences. R.B.

N70-26767# Congress. House. Committee on Science and Astronautics.
NATIONAL SCIENCE FOUNDATION 1970 AUTHORIZATION, VOLUME 2
Washington GPO 1969 645 p refs Hearings before Comm. on Sci. and Astronaut., 91st Congr., 1st Sess., No. 4, 17-18 Mar., 20 Mar., 24-28 Mar., and 1 Apr. 1969
Avail: Subcomm. on Sci., Res., and Develop.

Material is presented which was prepared by the staff of the National Science Foundation in support of its fiscal year 1970 program. It is supplementary to the testimony of witnesses at

hearings on the fiscal year 1970 authorization published in a separate volume and provides additional information concerning the programs, activities, and accomplishments of the Foundation, including considerations that have contributed to planning for fiscal year 1970 and for the longer term. See also N70-26766.
Author

N70-26796# Congress. House. Committee on Science and Astronautics.
THE MANAGEMENT OF INFORMATION AND KNOWLEDGE
Washington GPO 1970 247 p refs Presented before the Comm. on Sci. and Astronaut. 11th ann. meeting with the Panel on Sci. and Technol., 91st Congr., 2d Sess., No. 15, 27-29 Jan. 1970
Avail: Comm. on Sci. and Astronaut.

The congressional proceedings on the management of information and knowledge are reported. The objectives are: (1) to develop a background of technical and scientific information which is authoritative, timely, candid, and represents the point of view of the scientific community; (2) discuss current methods for conducting research; (3) provide information concerning availability of scientific manpower and educational needs; (4) provide information on matters of international cooperation and organizations concerned with science and technology. Subjects discussed include: computers, communications and the economy; the individual, the state, and the machine; and education for a changing world.
F.O.S.

N70-26797# Congress. House. Committee on Science and Astronautics.
INSTITUTIONAL GRANTS BILL, H. R. 35
Washington GPO 1969 359 p refs Hearings on H.R. 35 before the Comm. on Sci. and Astronaut. at the 91st Congr., 1st Sess., No. 2, 18-20 and 25-27 Feb. 1969
Avail: Subcomm. on Sci., Res., and Develop.

The hearings concerning H.R. 35, which is a bill to provide institutional grants for support of science research and education in colleges and universities are reported. Included are statements on the following subjects: (1) the impact of a National Science Foundation grant on a university, (2) the apportionment formula, and (3) the recommendations of the National Science Board. Bibliographies of the witnesses are also included.
F.O.S.

N70-26798# Congress. House. Committee on Science and Astronautics.
EARTH RESOURCES SATELLITE SYSTEM
Joseph E. Karth Washington GPO 1969 31 p ref Presented to the Comm. on Sci. and Astronaut., 91st Congr., 2d Sess., 31 Dec. 1968 *Its* Serial W
Avail: Subcomm. on NASA Oversight

The feasibility of an earth resources satellite system is reported by reviewing the existing technological base for remote sensing in satellite systems. The uses of this data in cartography, agriculture and forestry, oceanography, geology, and hydrology are discussed. It is recommended: (1) that NASA concentrate a much larger portion of its efforts and resources on this project, and (2) the use of automated spacecraft instead of manned systems.
F.O.S.

N70-26963# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
QUESTIONS ON ECONOMICS AND PLANNING OF SCIENTIFIC RESEARCH: COLLECTION OF ARTICLES
L. S. Biyakhman et al 16 Oct. 1969 290 p refs Transl. into ENGLISH from Vop. Ekon. i Planirovaniya Nauchn.-Issled. (USSR), 1968 p 1-198
(AD-701031; FTD-MT-24-195-69) Avail: CFSTI CSCL 5/1

Questions on the economics of science and training of cadres of specialists are investigated, analysis of the economic work of scientific establishments is provided, indices of appraisal of their activity are offered, and means of increasing scientific research work are set forth. In this volume questions are raised connected with the change over of Scientific Research Institutes, Design-Construction Organizations, and higher educational institutions to full or limited cost accounting, formation of scientific-industrial combines the development of objective criteria for appraisal of the activity of scientists. Proposals on economic experiments in the scientific establishments and higher educational institutions of Leningrad are generalized.
Author (TAB)

N70-27240*# National Aeronautics and Space Administration, Washington, D.C.
ASTRONAUTICS AND AERONAUTICS, 1968: CHRONOLOGY OF SCIENCE, TECHNOLOGY, AND POLICY
1969 437 p
(NASA-SP-4010) Avail: SOD $2.00; CFSTI CSCL 05D

A daily chronicle of aerospace-related events, decisions, and personalities is given for 1968. Data on NASA and world-wide satellite, space probe, and unmanned space flight activity are tabulated.
S.S.

N70-27292# Little (Arthur D.), Inc., Cambridge, Mass.
INDUSTRIAL BULLETIN, NO. 479, NOVEMBER-DECEMBER 1969
Dec. 1969 4 p
Avail: CFSTI

The relationship of economic development and technology transfer is illustrated by examples in various countries. The development and marketing volume of continuous-loop cartridge and cassette tapes and players are discussed. The use of tantalum in manufacture of capacitors for high reliability electronic equipment is described.
R.B.

N70-27441# Air Force Systems Command, Washington, D.C.
PROCEEDINGS OF THE 1969 AIR FORCE SCIENCE AND ENGINEERING SYMPOSIUM, VOLUME 1
1969 442 p refs Conf. held at San Antonio, 7-9 Oct. 1969; Sponsored in part by Office of Aerospace Res.
(AD-702507) Avail: CFSTI CSCL 14/2

Contents: Plasma diagnostics; The image isocon, Minuteman 2 weapon system, vulnerability; Heat transfer, nonmetallic interfaces; Niobium base alloys; Fiber reinforced composites; Air to air combat simulation; Aircraft subsystems performance; A new aircrew armor vest; Electron emission from solids; Failure studies, microcircuit metallization systems; Thermal shock failure in semiconductor devices; Orbiting systems simulator; Hypersonic monorail rocket sled; Conducting medium simulator, near and below ground; Solid propellant processing; Vocoders, Nonlinear data reduction, Air breathing propulsion systems; Aircraft stores safety; Geology problems, hard rock missile siting; and Simulation of ground motions, nuclear explosions.
TAB

N70-27442# Air Force Systems Command, Washington, D.C.
PROCEEDINGS OF THE 1969 AIR FORCE SCIENCE AND ENGINEERING SYMPOSIUM, VOLUME 2
1969 410 p refs Conf. held at San Antonio, 7-9 Oct. 1969; Sponsored in part by Office of Aerospace Res.
(AD-702508) Avail: CFSTI CSCL 14/2

Contents: Cross spectral analysis, On line pattern analysis, Record format language, Free fall dispenser fuze, Meteorological satellites, Diazo photographic reproduction, Ferroelectric crystals, Gas lasers, Atmosphere, Toxicology of bromtrifluoromethane, Survival in space, Subsonic flutter of a wing tail combination, Lifting surface theory, Radio polarimeters and direction finders, Turbulent plasmas, Reaction of ozone with hydrosilanes, Hypersonic high Reynolds Number tunnel, and Hypersonic reentry.
TAB

N70-27660# Congress. Senate. Committee on Aeronautical and Space Sciences.
NASA AUTHORIZATION FOR FISCAL YEAR 1971. PART 3: INTERNATIONAL SPACE COOPERATION
Washington GPO 1970 177 p refs Hearings on S. 3374 before Comm. on Aeronaut. and Space Sci. at the 91st Congr., 2nd Sess., 11 Mar. 1970
Avail: Comm. on Aeronaut. and Space Sci.

The extensive and successful cooperation which NASA established with over 70 countries in the 1960s is reviewed to show that a sound basis exists for seeking increased international cooperation. The efforts being made to give other nations an opportunity to study future programs are discussed from the viewpoint of the extent to which they may wish to join the United States in meeting the challenges of the 1970s. These challenges are forecast as the advancement of space science, the development of space technology, or the creative use of practical space applications for the benefit of people on earth. Statistical summaries are included on foreign civilian space budgets, international space activities, cooperative satellites and probe projects, coordinated satellite projects, foreign experiments on NASA satellites, cooperative sounding rocket projects, NASA international sounding rocket projects, cooperative ground base projects, and NASA international station agreements. M.G.J.

N70-27707# Congress. House. Committee on Appropriations.
DEPARTMENT OF TRANSPORTATION AND RELATED AGENCIES APPROPRIATIONS FOR 1970. PART 3: CIVIL SUPERSONIC AIRCRAFT DEVELOPMENT
Washington GPO 1969 255 p refs Hearings before Comm. on Appropriations at the 91st Congr., 1st Sess., 9 Oct. 1969
Avail: Subcomm. on Dept. of Transportation and Related Agencies Appropriations

The hearings on developing a civil supersonic transport aircraft are presented. Government findings, included in the evaluation of the design, are that the 2707-300 airplane is capable of meeting all SST program objectives, and the production model should provide the airlines a safe, superior, and economically viable aircraft with intercontinental range at full pay load. Also included are comparisons with the Concorde, and the TU-144. F.O.S.

N70-27715# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
[RESEARCH IN GENERAL PHYSICS, PLASMA DYNAMICS, COMMUNICATION SCIENCES AND ENGINEERING] Quarterly Progress Report, Period Ending 30 Nov. 1969
H. J. Zimmerman, G. G. Harvey, and S. J. Mason 15 Jan. 1970 269 p refs
(Contract DA-28-043-AMC-02536(E))
(AD-701215; QPR-96) Avail: CFSTI CSCL 9/3

The report contains a review of the research activities of the Laboratory in the fields of general physics, plasma dynamics, communication sciences and engineering. TAB

N70-27745# Congress. House. Committee on Science and Astronautics.
AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
1970 174 p Presented by the Comm. on Sci. and Astronaut. to the Comm. of the Whole House at the 91st Congr., 2d Sess., 19 Mar. 1970
(Rept-91-929) Avail: House Document Room

Committee-approved NASA appropriations for fiscal year 1971 are documented under three main programs: research and development ($2,903,200,000), research and program management ($693,700,000), and facilities construction ($33,975,000). E.C.

N70-27786# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
ELEMENTARY INTRODUCTION TO INFORMATION THEORY [ELEMENTARE EINFUEHRUNG IN DIE INFORMATIONSTHEORIE]
A. Wasiljeff *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 13 1969 p 233–241 refs In GERMAN (See N70-27752 13-13)
Avail: CFSTI

A simplified description of the basic principles of information theory is given. Steady signals may be transformed into a series of discrete signals by means of scanning and quantization. The terms entropy, channel capacity and redundancy are explained. With the aid of clear examples the coding of simple messages is presented. Author (ESRO)

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— NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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